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THE TEACHER SPEAKS

NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

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THE TEACHER SPEAKS

Volume 8

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NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

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Foreword

THE All-India Competition of Seminar Readings is an annual programme of the National Council of Educational Research and Training. The basic purpose of this programme is to give practising teachers and headmasters an excellent opportunity to discuss the educational problems and experiences that they are faced with in their day-to-day teaching and also the innovation they happen to initiate in their classrooms. Accordingly, the teachers and headmasters are invited to write papers based on their creative thinking or experimental findings related to the problems of school education. These papers are read and discussed in special seminars at the local, state and national levels in order to exchange new ideas and experiences among very large number of teachers throughout the country. That is why this programme is aptly named as "Seminar Readings".

The papers are first submitted to the Extension Services Departments attached to Secondary Teachers Colleges throughout the country. Each Extension Centre selects ten best papers and forwards them to the State Education Department, which in turn, selects ten best papers through State-level competition and sends them on to the NCERT. The final selection is made by the NCERT out of the total number of papers received from the States for the purpose of national award and a follow-up seminar.

The selected papers are also printed in the form of a book entitled "The Teacher Speaks" for wider dissemination amongst teachers and other educators.

This volume is the collection of the ten best papers selected out of a large number of papers received under the Eighth All-India Competition of Seminar Readings 1969-70. This volume is the eighth in the series.

The teachers who have written these essays and the many others who wrote the essays but were not so lucky as to get into the short list of prize winners should be congratulated for the efforts they have put in. In fact, the Council flourishes on the efforts of the teachers and always looks forward to their active co-operation and participation in all its activities.

It is sincerely believed that this volume would be of value to the teachers in the classroom, to headmasters interested as they are in promoting national integration and to a very large number of individuals who have zest and enthusiasm for the advancement of school education.

The views expressed in the papers are those of the authors.

This volume could not have seen the light of day without the active co-operation of the Hony. Directors of Extension Services Departments and State Directors of Public Instruction/Directors of Education. My most grateful thanks are due to them.

On behalf of the Council, I have to express my gratitude to the judges who evaluated the papers and to my colleagues Dr. R.H. Dave, Dr. L. C. Singh, Smt. S. Siddhu, Shri J. C. Goyal and Smt. J. Duggal of the Department of Teacher Education for organising the programme. I also thank Shri Negi and Shri Harish Chandra for their assistance.

Even the planning and production of a volume of this type is always capable of considerable improvement. I, therefore, look forward to suggestions and comments on the volume. All these will be most gratefully acknowledged and utilised for improving future publications.

New Delhi
January 30, 1971

S. V. C. AIYA
Director, NCERT

Preface

PROFESSIONAL growth of a teacher depends to a large extent on his ability related to creative reading and writing. It is through reading that he can get information about the latest innovations in the educational field. Through creative writing he records his thoughts, conveys the emotions and sentiments. No educational system can afford to have teachers who are slaves to the opinions of others and who cannot express their own ideas.

Recognising the need for encouraging teachers for critical reading and creative writing to improve their professional growth, NCERT initiated a scheme of Seminar Readings in the year 1962-63 and since then it has been regularly organised by the Council. The programme aims at stimulating serious thinking amongst teachers and making the result of their thinking available to the persons in the teaching profession. Under this programme teachers are invited to write papers which are based on (i) their own creative thinking, (ii) experimental findings, or (iii) a critical study of a problem related to their fields of work.

The essays are first submitted to the Extension Services Departments attached to Secondary Teachers Colleges throughout the country. Each Extension Centre selects ten best papers and forwards them to the State Education Department which, in turn, selects ten best papers through a State-level competition and sends them on to NCERT. The final selection is made by NCERT out of the total number of papers received from the States, for the purpose of national awards and a follow-up Seminar.

A national meet of the award winners is held where the papers are read out and discussed by the authors in the presence of resource persons representing various fields of specialisation, who guide the discussions. This kind of exchange of ideas between the specialists and the classroom practitioners is beneficial to both.

Cash prizes of Rs. 750.00, Rs. 500.00 and Rs. 250.00 under three categories 'A', 'B' and 'C' respectively are awarded in order of merit to each selected paper up to a total of 30, not more than ten being under each of the three categories.

Even those persons who are not recepient of awards, but have participated in the programme at different levels are also given recognition. Under this scheme, Extension Services Departments are expected to organise various educational programmes throughout the year in order to give recognition to their work by providing opportunities to express their views before others.

The papers selected under the first two categories are published by NCERT every year in the form of a book entitled **The Teacher Speaks.** This publication is distributed free to a large number of schools in the country to disseminate the ideas contained in the papers.

To give an opportunity to more and more teachers to participate in the programme and to ensure that the circle is not narrowed down to a few persons, it has been decided that the persons who win prizes for two successive years are not eligible for further cash prizes. They are, however, permitted to take part in the succeeding contests to promote higher standards of achievements. These authors are given certificates in recognition of their outstanding contributions.

This volume, as usual, contains the papers selected in categories A and B (ten only) at the national level in the eighth all-India contest of the Seminar Readings programme.

In the eighth contest of the Seminar Readings, 137 papers were received at the national level from 17 States including the Union Territories of Himachal Pradesh and Delhi.

In order to give more emphasis to the quality of the papers, the panel of examiners have selected only 20 papers this year for the national award instead of the maximum of 30 generally selected in the past contests.

The 20 awardees represent the following States: Andhra Pradesh 1, Gujarat 5, Jammu & Kashmir 1, Kerala 1, Madhya Pradesh 1, Mysore 5, Maharashtra 2, Orissa 1, Rajasthan 2, and West Bengal 1.

The present group of award winners consists of nine teachers and 11 Headmasters/Principals of Secondary Schools.

This year two papers have been selected on topics related to national integration, four on language teaching, four on teaching of science and mathematics, three on teaching of social sciences, four on administrative problems in the schools and three on miscellaneous topics like 'A School Complex in Action', 'A Project under Work Experience' and 'Under-achievers—What Can We Do for Them.'

Shri A. P. Oza, one of the awardees, has been submitting papers on different topics continuously for the last four years. It is creditable that his paper has been selected every year: This time his topic was "Mathematics Talent Search".

The programme is gaining popularity with the teachers year after year.

R. H. Dave
HEAD
Department of Teacher Education

New Delhi,
January 30, 1971.

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An Educational Project on National Integration

M. S. Kanthamani

THE problem of integration at present in India is a serious subject which has posed a challenge to the educated minds. Integration means bringing together certain elements which are capable of unification. It does not imply bringing about a dull uniformity in all respects. One can follow one's own faith, use one's own language, follow one's own profession and yet have the spirit of national oneness and belongingness. The concept 'unity in diversity' indicates that diversity and variety need not conflict with loyalty to the country.

There are disruptive forces in our country which tend to undermine the concept of national unity and we cannot ignore them. It is necessary to create proper and healthy atmosphere for children so that they could grow physically and mentally without being contaminated with undesirable tendencies. It is common knowledge that the children of today would become the citizens of tomorrow. From among them we will get the future leaders of our democratic country. Therefore schools should accept wider responsibilities in promoting a sense of national integration among pupils. The schools should provide a type of education which serves the purpose of creating a sense of belonging to the nation, unity, solidarity and inculcates faith in democratic principles.

Why I started this project ?

As a teacher of Social Studies I felt that pupils should know more about different States of India and not just confine themselves to the State they belong to. I was not satisfied with the bookish knowledge that they imbibe. I wanted my pupils to develop the attitude of fellow feeling towards people of all parts of India which in turn would lead to a greater understanding of the oneness of India.

This idea was discussed with persons interested in such educational endeavours. They welcomed the idea and suggested that an intensive study of six States of India, to start with, could be made by the pupils of the school, covering all possible details under a project entitled "Our India."

Objectives

1. To enable the pupils to understand that unity amidst diversity is the unique heritage of India.

2. To enable the pupils to understand the variety and richness of natural resources in different States of India which have contributed to the total wealth of the country.

3. To enable the pupils to realise the need for the inter-dependence of different States of India.

4. To enable the pupils to appreciate the contributions of regional languages of India to the enrichment of Indian culture.

5. To enable the pupils to appreciate the outstanding contributions made by the great men and women of India in all walks of life.

6. To enable the pupils to appreciate the contributions of art, architecture and painting of different States of India to the country as a whole.

7. To enable the pupils to appreciate the importance of fine net-work of trunk roads, railways and airways which have helped us in building a strong and united India.

8. To enable the pupils to collect, record and interpret data relating to different States of India.

Procedure

The project provided ample scope to work on all aspects of all the States in India. There was some difficulty in organising an activity covering all the States of India. Therefore, we decided to try out the project with only six States. In selecting the six States we omitted the southern States deliberately with a view to covering the regions other than the South, because of our familiarity with the southern region. The six States of India selected for our study were :—

1. Maharashtra;
2. Rajasthan;
3. Gujarat;
4. Kashmir;
5. Bengal; and
6. Assam.

Grouping

The total strength of our school was 186. The entire student population was classed into six houses and each house was named after the six States chosen for the project. Thus the six houses were named as Maharashtra House, Gujarat House, Bengal House, Kashmir House, Rajasthan House and Assam House. The grouping was heterogeneous and all houses included students from all standards. Two pupil leaders were selected for each house and a house master and two consultants from among staff members were nominated to assist the houses.

Each house further divided its members into three groups. Each group accepted the responsibility of one type of activity or the other related to the State to which they belonged. These are as below :

Group I —Collecting data—political, economic, social and cultural.

Group II —Representing the data in the form of maps, charts, graphs, posters, models, etc.

Group III—Organising cultural and religious activities including folk songs, Bhajans, Drama, Monoacting, fancy dress, etc.

All the houses planned their activities in the same way with slight variations. Thus an action plan was prepared for the project.

Collection of Data

The students of each house collected information pertaining to their State assigned to them. Generally the collection of information was based on the following areas in all the six States chosen for the project.

1. Physical features—climate and natural vegetation
2. Resources—mineral, animal and forests
3. Population and its composition
4. Political and administrative divisions
5. Major industrial centres and industries
6. Major irrigation projects in the State.
7. Places of historical, religious and tourist interest
8. Major agricultural resources
9. The people, their customs, food habits, dress, chief means of living and standard of literacy
10. Educational institutions
11. Major import and export products
12. Transportation facilities in the State
13. Important leaders of the State—political, social and religious
14. The pattern of Government at different levels
15. Art and architecture
16. Languages and literature.

Activities

As a part of the project the school arranged talks and discussions on some major aspects related to the six selected States. We celebrated the birth days of some of the great men belonging to those States. We also celebrated some of the festivals connected with the States taken for the project.

Further the members of different houses wrote letters to the children of schools in the six States with a view to getting first-hand information of those States. It is remarkable to note that the Pan Bazar Girls High School, Gauhati, responded encouragingly and sent gifts like shawls, gomachas, greeting cards, books and beads used in Assam. Similarly, other houses corresponded with the various agencies like :—

1. Information & Tourist Bureaux of the States
2. Survey of India Office, New Delhi
3. Statistical Department of the States
4. Audio-visual Department, etc.

The project was made more interesting to pupils by projecting feature films and film strips covering varied aspects of these States. This helped our students to get first-hand information about the life of the people there.

Our pupils showed interest in the type of food that the people of different States were accustomed to. They tried to know also as to why only a particular type of food was prevalent in the north and some other in south. They also prepared popular sweets of some States and distributed them to their friends. The pupils also collected information about the costumes of some States and wore them when taking part in a show. They made dolls dressed in different costumes. Thus the pupils appreciated diversified food and dress habits of the people of India.

Our pupils expressed a desire to learn popular songs of the States. Some eminent people of these States residing in and around our campus were invited to teach our pupils their songs. They were able to learn those songs effectively in a very short period. While learning these songs, the students found no difficulty of language.

This exciting experience in learning new songs gave impetus to our girl students to learn the dances of different States. Our girls learnt Garbha dance of Gujarat and folk dances of Maharashtra and Bengal.

To help consolidate, whatever students had found out about the six States we organised competitions in essay writing, debate, monoacting and elocution which gave them an opportunity to give expression to their feelings and knowledge about the six States.

The pupils prepared five posters in different languages. They also collected and read some important works of Tagore, Gandhiji, etc., in their own languages.

Time Consumed for the Project

In the school time-table two periods of 45 minutes on every Saturday were allotted for this purpose. During this period, the plan of the work was discussed, a review of the work done was made and guidance for future work was given. On every Wednesday morning, a brief report was presented in the school assembly on the work done by each house during the previous week. Besides the period of house activities, the students also did some spade work during their leisure time.

Progress of the Project

By the end of the fourth month each house had collected a good deal of information and possessed a variety of material with them. The students desired that an exhibition "Our India" be arranged to display all that they had done during the period of four months. Accordingly an exhibition was organised on 2nd October, 1969 to commemorate Gandhi Centenary. There could not have been a more fitting finale to this exciting project.

The enthusiam of the pupils knew no bounds on this achievement. We selected a few charts, maps and models for the exhibition. We selected exhibits on the following criteria :—

(a) Accurate and latest information
(b) Get-up and correct symbolisation
(c) Clarity and neatness
(d) Appeal to the visitors
(e) Relevance of the exhibit to the occasion.

The table below indicates the number of charts, maps, graphs, models and other collections made by each house.

State	*Maps*	*Charts*	*Pictures & Drawings*	*Graphs*	*Models*	*Fret work*	*Dolls*	*Class work*	*Collections.*	*Manuscript booklet*	*Total*
Maharashtra House	20	6	9	4	5	3	2	1	12	1	63
Rajasthan House	21	4	10	7	6	1	4	1	2	1	57
Gujarat House	12	11	5	5	4	1	2	1	39	1	81
Kashmir House	4	12	6	9	9	0	2	0	8	1	51
West Bengal House	14	14	14	2	7	6	2	1	7	1	68
Assam House	10	10	10	10	7	0	2	1	13	1	64
TOTAL	81	57	54	37	38	11	14	5	81	6	384

We invited Dr. K.L. Shrimali, the then Vice-Chancellor of the Mysore University to inaugurate it. As a part of the programme, pupils presented a brief cultural show consisting of the songs and dances they had learnt. They also presented a feature play covering the States selected for the project.

Observations and Evaluation

As this project was an important educational endeavour, we were keen on noticing certain behavioural changes in the pupils as the project progressed. The replies to the questionnaire given to pupils, the quiz and interviews conducted, showed better understanding of these States. The visitors asked numerous questions which our pupils answered well. The visitors were astonished at the good work done by our pupils in depicting various items such as Konsarnag lake, Srinagar City, Winter Sports of Kashmir, Himalayan mountains, Boat House, a Ship in a harbour, Rajgarh fort, Rana Pratap Sagar Dam, Gir Forest, Rope-Way bridge, Shantiniketan, Howrah Bridge, etc.

From the questionnaire we could also analyse that the pupils gained certain skills. While representing information through maps and charts, etc., ample scope was there for the development of practical skills, such as :—

(a) Drawing diagrams
(b) Enlarging and reducing maps
(c) Applying a suitable scale
(d) Shading the maps
(e) Developing keys to maps
(f) Colouring the maps
(g) Making models of various types
(h) Making posters and designs with Rangoli and colour powder.

The pupils developed certain other skills like :—

(a) Referring to relevant books
(b) Conversing with others for getting first-hand information.

Other qualities developed in pupils during the project works were leadership, habit of hard work, co-operation, responsibility, sociability, and curiosity. These qualities were graded on a five-point scale (Annexure II).

While our pupils were at work, we found that they identified themselves with the State they studied. They made attractive badges to indicate the houses to which they belonged.

The success or failure of the project could be judged by the changes in the attitude of the pupils as revealed through their own reports. Below are given extracts from some of the reports :—

A pupil changed his opinion about Assam thus : "I thought that Assam was a wild and dreadful State abounding in dangers but now I discover Assam as one of the most beautiful and attractive regions of India. This State is the richest treasure house of folklore, dances and music."

A student writing on Rajasthan acknowledges "Rajasthan is a land of valour and chivalry, sand dunes and beautiful lakes, art and architecture."

From the questionnaire it is analysed that all the pupils worked in a democratic spirit and the entire work was divided on the basis of the interest and skill of each pupil. There was maximum participation of pupils in all the houses (Annexure III). Whatever weaknesses we observed in this will serve as guidelines for our work in the future.

Follow-up Work

The analysis of the responses of pupils showed that a majority of them wanted similar work be undertaken for the remaining

States also. Further they desired that this project should be taken up as an inter-school activity.

After the project we found that our pupils showed interest in knowing more about the life of the people in different States through reading newspapers and other periodicals. Now it has become a habit with them.

The project has resulted in creating an ambition in them to visit some of the States of India. As a first step 82 pupils and 10 teachers have planned to go to Bombay and Poona in Maharashtra during the Christmas vacation this year.

Conclusion

The universal declaration of Human Rights, lays down that "One of the functions of education is to promote understanding, tolerance and friendship among all nations and among racial and religious groups." To promote understanding among the regions of our country which is an immediate issue facing us today should be a much easier task once we approach it with will and determination.

As indicated in the objectives of the project this was an attempt at the proper understanding of the people in different parts of our country. It is a well-known fact that the culture of India from the great Himalayas down to the Kanyakumari is one and indivisible. However, in habits, behaviour, mode of dress and the type of food, the people of different States in India show great diversity. National integration is essential for the progress as well as for preserving our hard-won freedom. It can be said that this project "Our India" conducted in our school may be considered as a useful and desirable effort in promoting national integration.

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7. Preparing Instructional Objectives, Robert F. Mager, Ph.D.
8. Improving Instruction in Social Studies, Volume 1–NCERT.
9. Classroom Research (Reports of Experiments and Projects) NCERT.
10. Improving Instruction A. V. Geography, NCERT.
11. Zonal Conference of Teachers on National Integration, NCERT.

ANNEXURE–I

Books referred by the students for 'Our India Projects' in the School

	Author	Titles
1.	N.C.A.E.R.	Techno Economic Survey of Rajasthan
2.	N.C.A.E.R.	Techno Economic Survey of Gujarat
3.	N.C.A.E.R.	Techno Economic Survey of West Bengal
4.	N.C.A.E.R.	Techno Economic Survey of Kashmir.
5.	N.C.A.E.R.	Techno-Economic Survey of Maharashtra
6.	Goswamy	Economic Development of Assam
7.	J. N. Kamalpur	The Deccan Forts
8.	P. B. Gajendragadkar	Kashmir–Retrospect and Prospect
9.	V. S. Gnananathan	Economic Geography of India
10.	Indian Council of Agricultural Research, New Delhi (ICAR)	Farmers of India (Volume I to IV)
11.	S. R. Tikekar	Maharashtra the land, its people and their culture
12.	Somareen Roy	Roots of Bengali Culture
13.	S. L. Sadhu	Folk tales from Kashmir
14.	M. S. Mate	Temples and legends of Maharashtra
15.	Sheobran Singh and J. Bansal	Kashmir and other related matters
16.	B. L. Sharma	Kashmir Story
17.	S. C. Banerji	Cultural heritage of Kashmir
18.	B. P. Lamb	India
19.	Government of India Publication	India : A pictorial survey
20.	P. C. Roy Choudhury	Temples and legends of Bengal
21.	Oxford University Press (Publn)	Leaders of modern India series
22.	National Council of Women in India	Women of India
23.	Shahani	Your holidays in India
24.	Bruhal	Indian Temples
25.	National Book Trust, New Delhi, S. Barkataki	Assam
26.	Engene Foodor and William Cutis	Guide to India
27.	Times of India Publication	Times of India Year Book and Directory
28.	Jamila Brij Bushan	Costumes and Textiles of India
29.	N.C.E.R.T.	Social Studies Part–I and II
30.	N.C.E.R.T.	Second All-India Educational Survey
31.	Yusuf Hussain	Glimpses of Medieval Indian Culture
32.	Tarachand	Influence of Islam on Indian Culture

ANNEXURE II

Maharashtra House

(A plan and an approach)

Topics selected for study to achieve the objectives	*Objectives*	*Activities provided for learning experience*	*Specification*	*Evaluation*
Maharashtra State 1.(a) Position and size (b) Physical features (c) Climate and rainfall (d) Soils (e) Political divisions	To enable the students to understand that unity amidst diversity is the unique heritage of India.	(a) Draws the position of Maharashtra in the map of India. (b) Physical features—clay model or plasticine model (c) Normal annual rainfall map drawing (d) Types of soil-map drawing (e) Cut-out maps (play-wood) political divisions and their district headquarters (f) Reads newspaper about weather and temperature of Maharashtra.	Recognises Discriminates Compares selects relevant information locates—draws maps and charts.	(1) Observation (2) Open discussions and interviews (3) Assessment can also be made by knowing how many activities a child takes part and how he organises and does things. (4) Teacher observes some of the traits of the pupils like leadership, taking up of responsibility, quality of work, co-operation, interest, curiosity to know about the state and how he responses towards the project. (5) Conducts certain tests and grade them. (6) Assesses student's products made during the project period.
2. Population	To enable the students to understand the total population of Maharashtra and its composition.	(a) Makes a chart of total population of Maharashtra in each district. (b) Total men and women chart (c) Occupational distribution of working population of Maharashtra—Graph	Participates in discussion. Collects relevant and accurate information. Compares and contrasts. Makes generalisation. Draws a paigraph by applying a suitable scale.	

3. Major rivers and its irrigation projects	To enable the students to understand that a river being a natural feature knows no political boundaries hence to construct a dam on the river requires the cooperation of all the political set-up.	I Refers : (a) Irrigation map of India (b) Physical features map of India II. Marks rivers, irrigation projects, multipurpose projects and hydro-electric projects on the map. III. Makes a papiermachie model of a dam in Maharashtra IV. Reads newspapers, magazines on river issues if any.	Consults reference books, selects relevant data locates, draws maps, discriminates.
4. Natural resources of Maharashtra. (a) Forest resources (b) Animal resources (c) Mineral resources	To enable the students to understand variety in natural resources is a source of national wealth	I. **Refers:** (a) Vegetation map of India (b) Mineral resources map of India II. **Refers:** Books III. Makes a chart on animal resources IV. Makes a chart on mineral resources and its uses. V. Collects the mineral resources, pastes the minerals found on the map of Maharashtra, in respective places where they are found. VI. Draws the vegetation map of Maharashtra. VII. Goes to a nearby geological museum to see important minerals and their uses.	Discusses with friends. Collects minerals and observes. Selects relevant data analyses. Draws maps. Prepares charts.
5. Agriculture resources, Industries, Exports and Imports.	1. To enable the pupils to understand the interdependence of different states of India 2. To understand what is produced in one part of the country shared by other parts.	I. **Refers** (a) Agriculture map of India (b) Industrial map of India II. Refers books III. Collects major crops and pastes the crops on the map of Maharashtra where it is found. IV. Draws major industrial centres of Maharashtra (map) V. Major textile centres of Maharashtra	Recalls Gives reason Predicts Compares Discusses every day economic problem Selects accurate data Draws maps Locates Collects serials, pictures and photographs.

Topics selected for study to achieve the objectives	*Objectives*	*Activities provided for learning experience*	*Specification*	***Evaluation***
		VI. Soil conservation and food scarcity area, per-capita commodity out-put district-wise (map) VII. Total requirements of food in Maharashtra and India (chart) VIII. Land utilisation in Maharashtra (paichart) IX. Bar Graph—Trade.		
6. Transport and communication of Maharashtra	To enable the pupils to realise the need for building a fine net work of trunk roads, railways and airways which have helped in building a strong and united India.	**Draws** 1. Air route map of Maharashtra. 2. Sea route map of Maharashtra. 3. Railway map of Maharashtra 4. Model of a ship in Bombay Harbour 5. Model of an airport	Draws maps Locates Collects accurate information	
7. Important leaders of the state, political, social and religious.	To enable the pupils to appreciate the contributions of men of Maharashtra, to the total heritage of India.	1. Reads important biographies on leaders of India in their regional languages. 2. Songs and prayers composed by the saints of Maharashtra are to be collected and recited. 3. Map of Maharashtra showing the birth places of leaders are to be marked. 4. Asking pupils to prepare portraits of saints of Maharashtra. 5. Scenes from the lives of great men and saints depicting their activities may be enacted. 6. Pupils may be given assignment to study the teachings of various leaders and saints. Some pupils may individually report these to assembly. 7. Invite a guest to speak on great men of Maharashtra. 8. A tableau may be presen-	Selects relevant information. Collects songs and line and recites Appreciates Draws maps and locates Compares Draws pictures and paints Enacts. Makes reports	

		ted in which each pupil dresses like different great men or saints and recites some of their composition. 9. Pupils are asked to prepare biographical sketches. 10. Collects pictures, photographs and stamps	Actively participates in the programme.	
8. Language and Literature of Maharashtra	To enable the pupils to appreciate Marathi Language as a National heritage and Marathi Literature has enriched the creative talents of the people of our country.	1. Prepares Posters in Marathi Language 2. Collects important literatures of Maharashtra State, and reads in their languages	Makes posters—voluntarily studies literature	*Similar procedure was followed in other houses also**
9. Cultural heritage of Maharashtra—art, architecture and music.	To enable the pupils to appreciate the contributions of art, architecture, music of Maharashtra to the country as a whole.	1. Prepares a touristmap of Maharashtra. 2. Collects important photographs, picture cards on important places of interest 3. Field trips. 4. Draws the map of Maharashtra. 5. Collects important folk songs, bajans and sings. 6. Makes artistic designs with rangoli and with colour powder	Draws maps Selects relevant data, paints participates in excursion. Draws pencil sketches. Collects songs and sings	
10. People, food, dress, custom and traditions.	To enable pupils to understand diversified food & dress habits of Maharashtra.	1. Collects pictures of men and women of Maharashtra with different costumes. 2. Prepares popular food of Maharashtra 3. Arranges for a tableau 4. Celebrates important festivals 5. Makes different dolls showing the costumes of the people of Maharashtra.	Interviews people for getting information Compares Discriminates Cooks Dramatises in the costumes of Maharashtra Makes dolls Unhesitatingly mixes with the people of other states of India.	
11. Educational development of Maharashtra.	To enable the pupils to understand the education system of Maharashtra.	1. Collects information, draws graphs and charts (pupils collect information from books on different aspects of Maharashtra, consult teachers, community people, write letters to their friends in Maharashtra, sees films, makes a written report, makes scrap book and exhibits all the materials at the end)	Compares Collects relevant data Draws graphs, makes charts	

ANNEXURE—III

Questionnaire

December, 1969.

Dear **Pupil,**

You have been working in a project called 'Our India' for the past four months. Since this is a new project that we tried out in our school, we would like to study how effective it has been. We would like to know in what ways you worked in the house and what gains you made. We have to see what are the advantages and disadvantages of the project. We have also to decide if this project is good enough to be continued or in what way it can be improved. This study is meant only for the purpose of improving the project not to make any judgement on any pupil or house. So you must give frank, bold and correct statements about what you have felt about this project. To help you in this we are giving below a number of important questions. Below each question a number of statements which will make the answers to the question. Check (√) those answers which apply to your or are correct in your case.

Be frank, honest, bold in making your answers thus it will help us in arriving at correct conclusions.

Thanking you,

Yours faithfully,

Identification Data

(1) Name of the Pupil

(2) Standard

(3) House to which you belong....

Tick the statements in the space provided in the left hand margin against each statement which is found to be correct.

1. How did your House work ? (As you are aware the entire school was divided into 6 houses namely, Maharashtra, Gujarat, Rajasthan, Kashmir, West Bengal and Assam).

—— 1. The leaders always decide what was to be done ?

—— 2. The House worked in a pleasant and a friendly atmosphere.

—— 3. Some members went on talking in an un-controlled way.

—— 4. There was much wastage of time in discussing unimportant or silly things.

—— 5. The House master was friendly and understaiding and considered the opinions of all members of the House.

—— 6. Items of the work were divided on the basis of the interest and skills of each member.

—— 7. We received good guidance from teachers when needed.

—— 8. We found much difficulty in finding out the information from the books available in the library.

—— 9. Some members of the house were shy or did not get enough opportunity for active participation.

——10. All the staff-members connected

with the house did not take active part.

II. What opportunities did this project give you? This project gave me opportunities to :

—— 1. Know more about the other states of India.

—— 2. Understand the life of the people in different states of India.

—— 3. Appreciate the customs of different states of India.

—— 4. Appreciate the food habits and customs of some states of India.

—— 5. Appreciate folk songs, Bhajans of some states of India in the language of those states.

—— 6. Understand the contributions of political, social and religious reformer of some states of India.

—— 7. Appreciate artistic talents of some states of India in music, dance and paintings.

—— 8. Understand the educational development of different states of India.

—— 9. Understand the various kinds of natural resources of some states of India and how they contribute to the total wealth of the country.

——10. Know the importance of the Agricultural development of different states of India.

——11. Understand the development of transport and communication in different states of India.

——12. Understand the industrial growth of different states of India.

III. What did you gain from this project?

—— 1. Better oral expression.

—— 2. Better newspaper reading habit.

—— 3. Reading books on different states of India.

—— 4. Better skills in writing diagrams, graphs and maps.

—— 5. Ability to read maps.

—— 6. Presenting the maps, graphs and charts neatly and accurately.

—— 7. Ability to do many kind of models.

—— 8. Better opportunities to see films on life and culture of different states of India.

—— 9. Preparing better type of posters.

——10. Ability to discuss with friends and teachers on an important problem.

IV. What disadvantages and difficulties did you feel about the project?

—— 1. Some members were not co-operative and remained idle while others did all the work.

—— 2. It encouraged unhealthy rivalry between two Houses.

—— 3. It helped only some to develop good personality others had to be passive followers.

—— 4. The books that were kept in the library were of very high standard.

—— 5. The books that were kept in the library were short of information.

—— 6. We could not get materials needed for the project well in time.

—— 7. The project work often led to quarrels among some members of the same House or between members and leaders of different Houses.

V. (a) Would you like such projects on other States of India to continue?

—mark one answer.

1. We want it immediately.

2. We want in near future.

3. We do not want it at all.

(b) If you would like such projects to continue mark 5 reasons why you think so.

—— 1. It helps me in developing better reading and collecting information about some states of India.

—— 2. It gives an insight to understand more and more about different states of India. Thus leads to the better understanding of India.

—— 3. It helped me to remove the narrow idea that I belong to Mysore State or Madras State.

—— 4. It helped me to feel that I am an Indian rather than Gujarathi or Rajasthani.

—— 5. It helped me to appreciate the need for the inter-dependence of the states.

—— 6. It helped me to appreciate the contribution made by different states of India to the total country in the field of art, architecture and literature.

—— 7. It helped me to understand the similarities between the different states with particular reference to food, dress and language.

VI. (a) If you feel that you have learnt some more significant things mention below:

1.

2.

3.

4.

5.

(b) Give your opinions about such projects to be taken in future.

1.

2.

3.

4.

Eradication of Untouchability as a Step to National Integration

K. R. Ghorpade

The Problem

UNTOUCHABILITY is a challenge to national integration and even to our hard-won freedom. It is the darkest spot on Hindu Culture. It has been a dangerous rock on which the ship of National Integration may dash any moment and get shattered into pieces. In spite of the efforts of eminent leaders and social workers and philosophers this evil of untouchability has survived all sorts of movements against it, and even after two decades of a democratic rule in the country, this evil is yet not only "alive" but is kicking hard.

In spite of constitutional provisions and legislations against untouchability, we find that hundreds and thousands of our Harijan brothers still wear "the badge of sufferance." Even to-day they are deprived of their rights of praying in temples, of entering hotels and of getting water at public wells; their dwellings are on the out-skirts of cities and villages. It is a sad reality that the Harijans by and large are leading a miserable life; many of them have embraced other religions like Buddhism. Thus they have nothing but bitter hatred against caste Hindus.

Any social thinker will accept unhesitatingly that a new progressive leadership has sprung up in our villages after the achievement of freedom but unfortunately this new leadership has also failed to fight against or appreciate the gravity of this social custom. And as such, all talk of social equality, equal opportunity, freedom and brotherhood is nothing but a volley of empty words!

National Integrity—the Need of the Day

Mutual respect, social and economic equality, the feeling of social cohesion, free social mixing, sharing of joys and sorrows—these are the essential pre-requisites of a free democratic nation. These deep feelings and sentiments alone can form the firm foundation for a new social order as they are the basic elements of National Integration!

Why have we failed miserably in the task of laying down the foundations of a free democracy? This is the problem facing our national leadership.

Education—the Right Weapon for New Social Order

The cause of our utter failure in facing this grave danger to our national life can be traced to our failure in finding out the right tools which can successfully bring about desired changes in the attitudes of the society. The efforts made in this direction have been honest, the workers had been zealous and patriotic, the Constitution-makers and the law-givers had no doubt been benevolent and yet their efforts could not yield the desired effects because their approach had been for all the time, economic, political, social and not educational.

Education alone can successfully root out undesirable thinking habits of a society, revolutionise social thinking and stabilize new set of values which can serve as foundation for the new society.

Robert Hoilbrour observes in this context, "If a society tied down by chains of old habits and set of values wants to transform itself into a new modern society, it can't do so only through its Economic Development. It can bring about its regeneration only through the acceptance of an altogether new set of values. And this new set of values can be incorporated in the social mind through education alone."

The Solution

Social justice based on equality is a value that can be imbibed by children during their school life. At that level they can appreciate and assimilate through constant active practice this value, and form right attitude towards all members of the society including the Harijans. Hence education must try to fulfil its task of building socially desirable attitudes. If education plays this role successfully, we shall be able to build a new society based on equality wherein there shall be no untouchables and no untouchability !

The Project

With this philosophical background the following project was tried out in the Jubilee Girls' English School at Miraj. The main purpose of the whole project was to stimulate social mixing, between the caste Hindu and the Harijan pupils and their respective guardians by infusing in them a sense of equality. A brief account of the procedure followed and the conclusions drawn can very well show that schools can play a very important role in eradicating untouchability and in building a new society.

The Procedure

1.—*Preparing the minds*

(a) *Pupils.* In our school pupils play a substantial part in the administration of almost all activities. The practice of self-government has been very successfully implemented; before introducing this project, its details were explained to the pupil leaders and to all the pupils. They were allowed to express their reactions freely. Some of them liked the idea, some others were ready to cooperate and participate but doubted whether their guardians would approve of the project. The Harijan girls were very shy at first because their houses, and their guardians were to be the focus of the whole project.

A regular publicity campaign followed through talks by teachers and outsiders, elocution competitions and essay competitions. The evils of untouchability were impressed upon the minds of the pupils and their cooperation was assured.

(b) *The Teachers*: There were varied reactions among teachers. Some thought that the project was superfluous because they believed that untouchability was a dead reptile and trying to kill it again, was wasting time and energy. There were some teachers who were able to understand and appreciate the importance of the project and wanted to help it but were doubtful about the reactions of the members of their families. A few however actually were eager to do something, to drive at least one nail in the coffin of untouchability. The teachers, almost all, helped in their own way to implement the project successfully.

2. *Visting the Houses of the Harijans*

As a next step class teachers and pupil leaders started visiting the houses of Harijan pupils of their respective classes. At every stage, group discussions were held to convince the pupils of the importance of the project, but it was voluntary to participate in the entire project or a particular stage of the project. Compulsion has its unhealthy reactions and hence it was avoided throughout the whole project.

The reactions to the visits were recorded by the teachers, pupil leaders and the Harijan pupils whose houses were visited.

Some Harijan pupils did not want such visits to take place because they were ashamed of exposing their poverty, the unhealthy environment in which they lived. This inferiority complex had to be overcome by explaining to them that the visits were arranged for getting introduced to their guardians and nobody would be unsympathetic with them. The pupil leaders were happy in doing the job with their class teachers.

The reactions of the teachers varied. To some the picture of naked poverty was an eye-opener. Some others wondered how their Harijan pupils could study in their small houses with only one room in it. Some teachers admired the cleanliness in the houses they visited. Some others were impressed by love and respect with which they were greeted in the houses of their Harijan pupils.

A few guarians of caste Hindu pupil leaders did not like the idea of their wards going to their Harijan classmates; therefore some half a dozen (out of the 112) pupil leaders could not participate at this stage.

The reactions of the Harijan guardians also varied. Many of them were pleased with the visits. A few smelt some political intentions behind it. Many were happy that they have clung to Hinduism and yet some had bitter criticism to offer against it. A number of them have embraced Buddhism and yet have maintained respect for Hinduism, but some were bitter about their old religion and tried to justify their conversion to Buddhism. Undoubtedly, these visits were a welcome beginning of social mixing, the absence of which is perhaps the root cause of bitter misunderstanding.

3. *The Rakshabandhan Ceremony*

The school has a tradition of celebrating Rakshabandhan day every year. The pupil leaders offer 'Rakhis' to pupils in their class. The General Secretary of the school offers 'Rakhi' to the School Flag and to the Headmaster and other teachers. The Rakshabandhan is the vow taken by the stronger to help their weaker friends in all possible ways. This year teachers and pupil leaders were asked to visit the houses of Harijan classmates and to offer Rakhis to their guardians. Again the reactions of the guardians and visiting pupils and the Harijan pupils were recorded. They were generally the record of love, hospitality, satisfaction and admiration. The threads of the 'Rakhi' were tied with love round many arms; these threads in fact tied them to the body of the society to which they belong.

4. *Gribabhojan*

This was the most delicate and yet very important step. The caste Hindu pupils were to invite their Harijan sisters in their class for meals in their houses, with the previous permission of the parents or guardians, and with full guarantee of equal and respectable treatment to them. The whole procedure was explained to the pupils and they were asked to come forward with invitations voluntarily. This was the real test of the whole project. The Headmaster and some teachers had to start with this activity from their own houses.

When some pupils observed these examples they became bold enough to follow them. A number of pupils came forward with willing invitations for meals at their houses for their Harijan classmates. Almost all Harijan girls were invited for meals by their caste Hindu friends. All the girls were treated with love, equality and were warmly welcomed by the mothers of the inviting friends. They took their meals in the kitchens of their friends; the food was served by the mothers and the Harijan girls enjoyed the meals.

However, in one instance, the Harijan pupils invited for meals were not treated with due respect and equality. Utmost efforts were made thereafter to see that such incidents did not repeat. The reactions of both Harijan pupils who went for meals and caste Hindu pupils who invited them were recorded. These reactions show that the evils of untouchability can be removed only through education. Almost all Harijan pupils expressed their joy and satisfaction at the treatment that was given to them in their friends' houses. The caste Hindu pupils also showed their capacity to rise to the occasion in fulfilling their sacred duty.

5. *Sahabhojan*

In the previous stage, only a limited number of pupils could participate. Therefore the programme of Sahabhojan in which all pupils could participate was organised on the 2nd of October, the Mahatma Gandhi Jayanti Day. Food was served by Harijan pupils also. Eighty-five per cent of the pupils participated in this programme; those who did not participate were unable to do so for some personal reasons like home engagements, etc., and not due to specific dislike for this programme.

6. *Satyanarayan Pooja*

The next stage was the Satyanarayan Pooja at the hands of a Harijan couple. On 17th Oct. Mr. and Mrs. Satpute the parents of one Harijan pupil, performed the Satyanarayan Pooja in the school. A priest was invited and all religious rites were performed under the guidance of the priest. Teerth and Prasad (तीर्थं प्रसाद) was distributed among all pupils and many guardians also. The work of distributing **Prasad** was entrusted to Harijan pupils. Among the guardians assembled, there was also a large number of ladies.

7. *The Vow against Untouchability*

On 6th December, 1969—Dr. Ambedkar Jayanti Day—separate Pratigyapatrakas (प्रतीज्ञा पत्नक) were got printed for pupils of the school and their guardians. Through these the pupils and their guardians declared that they were against the observance of untouchability, and they believed that a new society based on equality and fraternity alone could build a strong and united India. All the pupils responded and signed these leaflets the pratigyapatrakas. A large number of guardians also (95 per cent) came forward to sign them.

There were, of course a few, about five per cent guardians, who did not like to commit in writing against untouchability. They were told that they might sign the pledge only if they liked to do so.

It cannot be claimed that all those who signed this pledge would stand against untouchability in their future life. Many might have signed due to the pressure of their daughters and yet it cannot be denied that this also had some effect on their attitudes towards this evil.

8. *Future Programmes*

(a) An exhibition of pictures of great thinkers, writers, saints who stood against the evil of untouchability will be organised.

(b) A leaflet expressing the thoughts and words of such writers, etc., against this evil will be got printed and circulated among the pupils and their guardians.

(c) One-act plays on topics like Mandir Pravesh, (मंदिर-प्रवेश) life and work of Ekanath, etc., will be got written and will be enacted by the pupils at the time of the Annual Social Gathering.

(d) Successfully implemented programmes like visiting the houses of Harijan pupils, Grihabhojan, Sahabhojan and Satyanarayan Pooja at the hands of a Harijan couple will be included in the yearly routine of the school.

Encouragement and Evaluation

(a) On the 30th day of September, 1969, Hon. Shri Madhukarrao Choudhari, the Minister of Education, Maharashtra State while on tour appreciated the project and the spirit behind it.

(b) A group of nearly 45 selected Headmasters, from the four districts of Sangli, Satara, Kolhapur and Ratnagiri discussed the project with the pupil leaders. They put various questions to pupils in order to test whether they were following the activities of the project with due understanding. This questioning and discussion continued for nearly two hours. It was conducted by the Headmasters in the presence of Mrs. Leela Patil, the Principal, S.M.T.T. College, Kolhapur, and Prof. Keskar, Dr. Goyal, the representatives of the Extension Services Department, Kolhapur and the N.C.E.R.T. The Headmasters were fully satisfied and expressed their admiration and were happy to note the successful implementation of the Project.

Conclusions and Educational Implications

(a) Untouchability is still to-day a grave problem and stands as a challenge to our social unity and National Integrity. Even though the Harijans form a part of the body of the society, social mixing is absent.

(b) Untouchability has its political, social and economic consequences and yet lack of social mixing is a very important, if not the only one, root cause behind.

(c) Whosoever, wants to eradicate untouchability will have to remove this root cause.

(d) A beginning in this direction can be effective if we start with children whose attitudes are in the formative stage. It would be better to let alone the adults whose attitudes towards such problems have become rigid.

(e) Purposefully guided and psychologically graded educational activities, curricular as well as co-curricular, can lead to conscious or unconscious development of deep positive sentiments in children. If such sentiments as equality, mutual respect, fraternity towards one's fellowmen are developed in childhood and if they meet with a planned follow-up programme, they have a great carry-over value, as they become the part and parcel of the child's integrated personality.

(f) For the building up of 'A new society' 'a new man' will have to be created. The school is the cradle for this new man, a man with new rational thinking in harmony with the new times and challenges.

(g) A programme of social service is not an appendage to our educational system; it is rather an important tool of education.

(h) For a developing country, like India, education cannot be equated to information and schools to information centres. They have to be centres of new attitudes and centres of social service, "Education through Social Service and for Social Service" is the only way for regenerating Society.

(i) Even with the successful implementation of the above project, it is not claimed that such efforts alone could eradicate untouchability. Such projects have their limited contribution to make in this direction. But what is important is the formation of attitudes on the part of pupils, their teachers, and their guardians.

It can be stated without any hesitation that this tried-out programme in the Jubilee Girls' English School, has been successful in creating a new outlook of sympathy and understanding towards the problem. The teachers, the pupils and their guardians have advanced at least one step on the path towards the goal of eradication of untouchability which in itself is a step towards the largest goal of National Integration.

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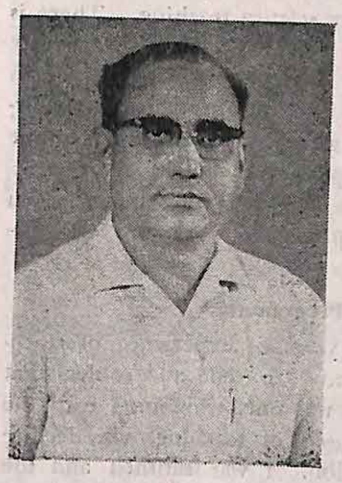
Physics Without Tears



G. *Madhava Rao*

It was a day during the final year of Physics Course for Class XII. The teacher, a stocky, broad-chested man with curly, salty and pepper-grey hair, half sleeves, pock-marked face and prone brow, restlessly paced the floor as the children took their seats. At the opening bell he sprang to the blackboard and wrote in bold letters, 'THE ELECTRON' has conquered Physics! Then he marched to one side of the room where there was a sturdy table. The table was littered with cells, resistance wires, rheostats, connecting wires, coils, galvanometers, a football, a lemon, metal pieces, a potato, chemicals, beakers and other odds and ends. The teacher called upon a boy to go over to the stage and kick the football. The children were intrigued. Then followed some demonstrations—electricity from a lemon, the simple Voltaic Cell, the passage of current through various resistances. A session of questions and answers followed. The lesson was in fact, a 'spill over' from the previous day's discussion. The problem of E.M.F. was analysed. Analogies were elicited The teacher declared, "A FOOTBALL goes on MOVING when the 'EMF' is removed from it. ELECTRONS DO NOT." The children were interested, amazed. Their wonder grew. The teacher continued; "*The Brake slows down the whole bicycle wheel-Resistance slows down the whole electron stream.*" The children nodded assent with enthusiasm. 'There is a law in Physics you'll never forget' cried the master triumphantly.

That was a typical physics lesson at the Government Multi-purpose High School for Boys, Nampalli, Hyderabad, in Andhra Pradesh.

Teaching has a romance of its own. Is teaching a science or an art? It is both. Reader defines teaching as the 'act of helping someone to learn, that is of helping him to acquire knowledge, attitudes, ideals, habits or some other type of learning which he did not previously possess.' Teaching is the stimulus and learning is the response.

In many places there still lurks the shadow of the mistaken idea that anyone who has been taught can teach. Belief in this

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point of view, and the use of teaching methods derived therefrom, may be the cause of considerable poor science teaching. There is no denying the fact that to teach effectively one must *know*. But 'knowing' here carries far more subtle implications than just knowing science. A good teacher is aware of the psychological significance of class-room practices. He knows the conditions under which learning goes on *economically* and *effectively*.

The Plan And Programme

Of my 22 years of experience of teaching Science, I must concede and confess that the first decade was one, wherein, I used the traditional methods of teaching, viz., lecture and demonstration. I was satisfied and the children had no grouse or complaint. That was the 'Ripvan Winkle Decade' of my career. But during the course of the last decade or 12 years, I have been experimenting with new ideas and innovations and have woken up from the Ripvan Winkle slumber, a newer and wiser man. The reason? The various orientation programmes I had the privilege of attending, my participation in the various Seminars and Workshops arranged by the Extension Services Department, SCERT, NCERT, etc.; Summer Institute Programmes and my association with the Regional Colleges of Education, the American Peace Corps and other academic agencies have given new dimensions to my teaching skill and contributed effectively to my professional growth. I have also, in addition, utilised the cumulative experience of all my pupils, both past and present, in attempting this paper.

Physics without tears does NOT mean that there is a short cut to the *teaching* of Physics. Indeed the teaching process implies and involves a lot of preparation, imagination and hard work and effort on the part of the teacher. It is the *learning process of the child* that is *without any tears*. Indeed the teacher prepares the cake of physics by the sweat of his brow for the children to share the sweet cake and digest it.

I would 'label' the all-round preparation of the teacher as preparing the instructional material for the teaching unit. What is this instructional material? The details are spelt out in the succeeding paragraphs.

Here I may mention that many of the statements to follow may sound platitudinous. But most of them are highly practicable. With a little patience and some enthusiasm it is possible for a dedicated teacher to prepare, I have found the material to be amazingly workable. A new and fascinating world is unfolded. The greatest and noblest pleasure I have had in this regard is that children begin to discover 'new' truths by themselves. Like a child learning to walk, the pupil learns to use his new found power. He no doubt commits mistakes but these must be counted as stages in the process of learning. Whether or not we plan that the children should become 'scientists', the more they learn about things and their environment, the more interested in them they will become. They become more interesting persons too.

Next to the 'over-all' preparation referred to above, comes the specific preparation aimed at comprehension. We as teachers usually tend to forget that frequently the principle is far simpler than the application.

That is the plan and programme. Without further ado I address myself to my task.

The Instructional Material

The evolution of man from the 'Cave' to the 'Moon landing' is an exciting and long drawn out story. In comparison with the eons since life on dry land detached itself from the mire, the centuries of scientific progress are but a moment in the history of the race. The children of today are living in a rapidly changing kaliedoscopic world. Today science is perhaps unique as a subject in the curriculum of schools all over the world. Life in the modern world has become so complex and science has entered so much in the common man's life that no individual can adjust himself to the physical environment and live a rich and full life without a considerable amount of scientific knowledge. Educationists in our country have recently bestowed special attention to science education. Many projects and schemes have been devised for improving science education and reorienting it to suit the needs and conditions of the present day. If science is to be learned effectively, science must be experienced. It must be learned and not learned about. Good science teaching must be based on observation and experiment. There can be no substitutes for these. The instructional material is meant to fulfil this felt need.

The instruction material is not to be confused with the 'Teaching Diary' or the 'Lesson Notes'. It is by and large a blend of the 'Teacher's Guide Book' and the 'Curriculum Guide Book'. One need not wait for experts to write out the instructional material. Classroom teachers, who are field workers in education, can attempt to bring forth their own versions on the basis of their rich experience. If teaching is to serve its greatest function, it must train children to think. Thinking must be done with laws, facts, and principles. There is no quarrel with content as such but only with the use to which it is put.

The Instructional Material—What it is?

To quote Sri Nigam, "The Instruction Material is ultimately a teacher's material medium through which he communicates to others his vision of classroom instruction." It is a concrete symbol of his measure of preparation and an effective aid to teaching and testing.

In a normal classroom situation, the teacher has to face a group of children that is as varying as its number with respect to age, physical maturity, emotional control, intellectual attainment, skills, appreciations, background, understanding, etc. This is the raw material with which the teacher must work. It is the teacher's supreme task to remove the faulty imprints of the child's previous experiences and to add, through the deftness of his artistry, something of lasting worth to the growing creation. Thus, it is no exaggeration to state that the task which confronts a teacher is one of high complexity and one which carries with it the deepest obligations.

Instructional materials are tools in the hands of the teacher and aids in the growth of the learner. Lessons have to be drawn up and learning experiences provided in terms of the learner and the particular unit of instruction being taught.

A few of the basic and fundamental determinants in the preparation of instructional material are enumerated below:

(i) The units of the syllabus are not to be taught in isolation; the syllabi of the lower and the next higher classes have to be considered and the teaching method geared accordingly.

(ii) The instructional material should aim at making the units of the syllabus more purposeful and the teaching process more effective. It should present the individual topics in the right perspective.

(iii) The instructional material should result in the enrichment of the syllabus.

(iv) The instructional material and the techniques based on it, should, by and large, be flexible.

(v) The instructional material should take into consideration the nature of the learner, the interests of the child, the immediate and delayed needs of the young people.

(vi) The instructional material should aim at exploiting effectively and to the full the resources of the school, the home and the community.

(vii) The instructional material should draw freely all assistance from material and sources like text books, reference books, professional and technical Journals, brochures, bulletins, radio lessons, newsletters, films, and film strips, charts and models, laboratory devices and kits, Teachers' Handbooks and Manuals, Children's Work books and Desk works, etc.

(viii) The instructional material should subserve and centre round the various academic innovations in the classrooms, like :

(a) suitable attention to the order and arrangement of topics and lessons.

(b) dividing and trimming the syllabus into suitable teaching units.

(c) the Project method and the problem method of teaching.

(d) Children's work sheets.

(e) Extension lectures.

(f) Innovations in the evaluation programme.

The main physical features of the blueprint of a good instructional material in general could be organised in paragraphs headed :

(i) *Overview*: Herein we spell out the overall picture of the unit under study which comprises a number of "teaching sub-units"—a broad area of the syllabus.

(ii) *Major Concepts* That is a visualisation or generalised notion, thought or idea made up of partial meanings or minor concepts. The stress should be on physical concepts rather than on Mathematical jugglery. The general philosophy is an emphasis upon a limited number of unifying principles that are essential for an understanding of the laws.

Illustration: A ray of light bends as it passes from one medium to another.

(iii) *Minor Concepts*: (a) The ray of light should be obliquely incident at the boundary surface of the two media.

(b) Bending takes place at the bounding surface.

(c) There is no bending when the incident ray is normal to the boundary surface.

(d) A ray passing from a rarer to a denser medium bends towards the 'normal'.

(e) A ray passing from a denser to a rarer medium bends away from the 'normal'.

(f) A ray of light passing through a prism bends towards the base as it enters the prism and as it leaves the prism.

(g) The refraction occurs because light travels at slightly different velocities in different media.

(h) Refraction causes many illusions.

(i) *Teaching Items or Steps in the Learning Cycle*

1. Previous knowledge
   (a) Pre-test of understanding.
   (b) Recall of previously learned principles.
2. Development
   (c) Setting the problem for study.
   (d) Co-operative plannng for the solution of problems.
   (e) Formulating hypotheses.
   (f) Testing hypotheses.
   (g) Reaching conclusions.
   (h) Teacher-sponsored experiments.
   (i) Child-sponsored experiments.
3. Organisation of learnings.

(v) *Learning Experiences*

The learning experiences will need to be so shaped that they lay hold of the immediate interests of pupils as well as provide for deep and abiding interests in the subject. The important thing is that in making plans for learning experiences the teacher becomes habituated to the practice of sensing the most promising opportunities offered by the materials for developing comprehension. The child is exposed to these experiences:

(a) Reading.

(b) Experiments.

(c) Interviews.

(d) Field-trips and excursions.

(e) Drawings.

(f) Observing demonstrations.

(g) Presenting reports.

(h) Presenting demonstrations.

(i) Film and film-strip shows.

(j) Radio lessons.

(k) Preparation of models.

(l) Maintenance of log books.

(m) Improvisations.

(n) Collecting and preserving specimens

(o) Recording and analysing scientific, meteorological data, etc.

(p) Investigational type of experiments.

(q) Participation in science competitions.

(r) Science exhibitions and science fairs.

(vi) *Evaluation*

(a) A blue-print of objectives to be tested, behavioural changes expected and evaluation tools needed was drawn up.

(b) In addition to the traditional essay type of questions, due weightage was given to various forms of objective type tests, short answere type tests, oral tests and practical tests.

(c) A unique feature was that internal assessment formed an integral part of the evaluation programme. Credit was given to the child's written work, home work, assignments, manipulative skill, his attendance, punctuality, character and conduct.

The aims were mainly:

(i) to lessen fear and tension on the eve of examinations.

(ii) to promote regular study and discourage guess work.

(iii) to improve pupil-teacher relationship.

(iv) to improve the tone of the school by keeping the children profitably active throughout the year.

(v) To make the evaluation programme a real and purposeful tool of teaching and guidance.

The tools of evaluation:

(A) Non-written Type:

(i) Oral Tests.

(ii) Simple Practical Tests.

(iii) Projects—Individual and Group activities.

(iv) Records.

(v) Teacher's Observations and Grading of personal qualities of children.

(B) Written Type (Pencil & Paper Type)

(i) Assignments.

(ii) Written examinations.

(a) *Form of Question*:

(i) Essay type.
(ii) Short answer type.
(iii) Objective type.

(b) *Weightage to Question*:

(i) Knowledge objective 50 marks.
(ii) Skill objective 30 marks.
(iii) Application objective 20 marks.

The "Unit Tests" were essentially used as class tests when a particular topic or topics covered by the test were completed. However, these tests were given as home assignments also, sometimes. These were also used as pre-tests especially when the topic being taught was repetitive in nature, i.e., in cases where the fundamentals of the topic had been learnt in the lower classes.

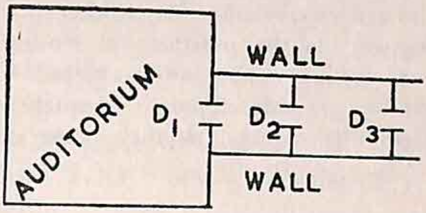
Comprehension through Analogy, Application and Co-ordination

It has been my experience that analogy plays an important role in comprehension. The 'bicycle wheel' analogy to the 'complete circuit' in electricity cited in the opening paragraph of this 'paper' is an instance in point. Children do not comprehend easily why there is no 'current' in any part of the circuit when the circuit is 'broken' at one point. Similarly, the beginner feels intrigued when told that the relative positions of the items of apparatus in a Series Circuit are not important. The 'wheel analogy' and its extension help to clear the confusion.

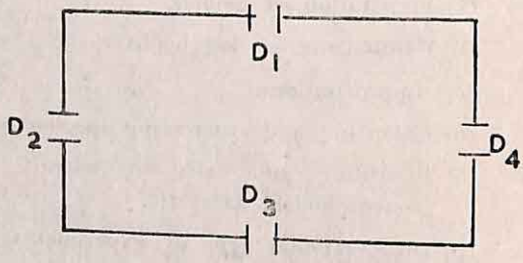
Numerous instances of this 'Analogy' tool could be cited. But I shall confine myself to a few.

Sl. No.	*Electrical Concept to be explained*	*'Water' Analogy*	*'Heat' Analogy*
1.	Quantity of CHARGE	Volume of Water.	Quantity of heat.
2.	Electric Potential	Level of water or Pressure of Water	Temperature.
3.	Electric Capacity	Capacity of Container	Heat Capacity

Similarly, a number of resistance in series could be compared to a large auditorium, full of people, having a number of doors but all in a line D_1, $D_{2,3}$ are the doors but the 'resistance' offered to the people to move out is not in any way diminished as the doors are in series. In fact, the narrowest door of the three determines the degree of 'resistance'.



In my experience, children are intrigued when informed that the effective resistance of a number of resistances in parallel is less than the lowest individual resistance. The derivation of the formula and problem-solving in this regard do not help much in clarifying the basic principle. The auditorium analogy comes in very handy. The auditorium described above is now taken as having a number of doors in "parallel", (i.e., the people have more than one way out at their disposal). These alternative "exits" effectively minimise the 'resistance'. Children are convinced and never forget the principle behind parallel resistance circuits.



Again, a number of condensers in series may be construed as one condenser with its plates farther apart, whereas a number of parallel condensers may be looked upon as one with large plates.

Lots of instances abound wherein comprehension could be achieved through relating the concept involved to real life situation. The difference between 'Force' and 'Pressure' could be explained very clearly by tapping the experiences of the child. Real life-situations like the "sharp point" of a pin, the broad tyres of a double decker, the broad continuous chain of a military tank, the shape of the foot of a camel and a host of others could be used and the difference between the two words, 'Force' and 'Pressure' brought home to the child.

A word about 'co-ordination' at this juncture will not be out of place here. We teach a number of topics in physics but do so in 'isolation', i.e., as isolated topics without proper co-ordination. I shall cite an instance to make my point clear. We teach the well-known principle that a body immersed in a liquid loses a part of its weight. The 'why' of the apparent loss is explained by considering 'buoyancy'. But 'where' the loss in weight goes' is an intriguing question. It leads to many 'puzzlers' in physics. But the 'puzzle' could be easily explained if we co-ordinate the previous knowledge of the child with the present situation. The child knows about Newton's III Law. The 'buoyant force' is the 'Action' here and the 'reaction' is felt by the bottom of the container. The 'apparent loss' is counteracted by the "apparent gain" experienced by the bottom of the beaker. If the beaker could express itself, it would perhaps howl at us when a large body is immersed in the water (or liquid) contained in the beaker. Even though the stone is not touching the sides or bottom of the beaker, the bottom experiences a greater thrust now than before the stone was immersed. The 'reaction' of the 'buoyant force' is usually lost sight of and this lack of co-ordination makes comprehension incomplete.

Other examples:

(a) The force between two molecules —two balls connected by a spring.

(b) The 'sticking' together of two freshly cut lead surfaces—inter—molecular attraction.

c) The three states of matter—models showing the arrangement of molecules.

(d) Locks (in rivers, etc.)—inter-communicating vessels.

(e) Refraction—a broad column of soldiers crossing the boundary line between a paved and a sandy stretches of ground (obliquely).

(f) Wave phenomena—long springs—light and heavy.

Only a few examples have been cited here. A resourceful teacher can improve upon these and devise and think of many more to suit the topic and the classroom situation.

Doing While Learning

There is no gainsaying the fact that backward and developing countries like ours, which cannot afford even the basic physical facilities needed for schools, have to rely mainly on human resources. We have to learn to put up with ill-equipped laboratories and overcrowded classes for some years, even decades to come. Sophisticated items of laboratory equipment are prohibitively expensive. But it is an erroneous belief that laboratory teaching requires elaborate equipment made by commercial manufacturers. It should be realised that science is sufficiently taught and learned when both teacher and pupils engage themselves usefully and profitably in various fruitful activities.

The activities are:

1. Demonstration Experiments.

2. Improvisations.
3. Investigations.
4. Maintenance of Albums and Log Books.
5. Portrait Gallery.
6. Projects and Ingeneous Experiments.
7. Science Exhibitions and Science Clubs.
8. Participation in Science Fairs, National Science Talent Search Competitions, etc.

(a) *Demonstration Method*: This method is too well known and needs little elaboration. This method saves time and expense. It is time-honoured and has proven to be effective. It has the advantage of being easly adapted to a logical development of content.

A list of experiments was carefully prepared for each teaching unit. These were demonstrated in the classroom with the cooperation of the pupils. The children were allowed access to the materials before and after the demonstration.

In the teaching of certain 'units', the 'inductive method' was found to be very advantageous. Under the circumstances, the demonstration was so planned that it functioned, more or less, as a controlled experiment.

Invariably, the demonstration was followed by a discussion touching upon the recording of observations, interpretation of data, precautions to be observed, etc.

(b) *Improvisation*: As stated at the beginning of this chapter, most of our laboratories are ill-equipped. It is incumbent on the part of the teacher to arrange for the preparation of these articles temporarily. These 'teacher-prepared' items are 'improvised' pieces of apparatus.

A list of improvised apparatus prepared in our school with the co-operation of children is given a few paragraphs below.

It is important to state that these simple improvisations, and in some cases, even improved apparatus, should not under any stretch of imagination, be regarded as stop-gaps or make-shifts. It is worth noting that grandma's techniques in the home are essentially good science. Simple experiments and exercise of constructing cheap and improvised apparatus are in the best traditions of science. Great scientists of the world used only such apparatus and the richest contributions to science have been made with improvised equipment. And I am proud of being dubbed as 'a sticks, strings and sealing wax scientist.' Therein lies the way for the improvement and enrichment of science teaching. It is of little use presenting the child with some costly and sophisticated piece of apparatus and call upon the child to read a guage or dial without his really knowing what goes on inside. Hence my job and that of children was one of devising, designing and construction of simple laboratory equipment from cheap materials available in our neighbourhood. We could thus bring about an admirable marriage between the laboratory and the parlour.

All told we have more than 50 items of improvised apparatus and more than 100 models and experiments besides a number of charts, portraits and Science quotes.

I cannot at this juncture resist the temptation of describing the event of improvising a hydrometer. The regular lesson on density was over. The problem of improvising a variable immersion type of hydrometer came up. It was elicited that the apparatus was nothing but a loaded glass tube. Various suggestions with regard to improvisation were offered. Glass tubes, test-tubes, short-length polythene tubes, drinking straws were a few among the suggested items. Suddenly one boy had a brainwave. He shouted, 'a stick'—a "broom-stick"! There was giggling all round. But then I protested, 'why not?' A broom-stick was taken and put in a jar of water. It did not 'float' vertically. The problem was to make it vertical. Well, very many suggestions were put forth. One of them was accepted. It was to fix a pin—a drawing pin—at the bottom. It worked allright. The improvised hydrometer was put in water. The level to which it sank was marked on it. That represented the density of water.

The 'apparatus' was put in kerosene and again the level marked. Taking the density of kerosene as 0.8 gns. per cc., the 'instrument' was calibrated.

The next day, the children—almost all of them—had brought their own hydrometers. They were all bubbling over with enthusiasm. The laboratory was like a hornet's nest which had been disturbed. The children were trying to determine the densities of various liquids—alcohol, petrol, coppersulphate solution, saturated solutions of salt and sugar, of ink, of milk, coffee, tea and so on.

Research and achievement were writ large on their faces and the laboratory was literally littered with broom-stick hydrometers, drinking straw hydrometers, test tube floats and other improvised varieties of hydrometers. This experience had its impact on me and it triggered off a campaign regarding the preparation of improvised apparatus.

Albums and Log Books

The children are maintaining the following:

(i) Album on optical illusions.

(ii) Album on portraits of Scientists (30).

(iii) Science Information Log Book (cuttings from Journals, Newspapers, (etc.—categorised).

(iv) Meteorological Data.

Investigations

There is no denying the fact that not all pupils who study science will choose science as their career but every student will need at least a basic knowledge of the facts known to science and the ability to distinguish fact from fallacy. Investigations in science promote both these objectives. In this project, the student first becomes intrigued and then gets interested in a phenomenon. He then makes an attempt at collecting information about it. After collecting a mass of information he reaches a 'frontier' of knowledge—a take-off stage—when he starts asking an experimental question—a question to which he finds an answer through active 'research'.

As part of our Science Club activities a number of investigations were taken up.

Investigation No. 1.: The relationship between the voltage produced by a Cycle Dynamo and the speed of the wheel.

Investigation No. 2.: Determination of the time taken to raise through 20°C, (a) 100 c.c. of Tap Water (b) 100 c.c. of Salt Water (saturated solution) and (c) 100 c.c. of Sand.

Investigation No. 3.: Measurement of the fusing Currents of Wires.

(12 V. Source with a Rheostat)

Investigation No. 4.: Acceleration in liquids of different densities:

Other Investigations. (under Way):

1. Bouncing Balls.
2. Paper—Examining various brands with reference to: (i) density, (ii) tensile strength, (iii) Tearing (Force needed), (iv) Absorbing capacity, (y) Puncturing (Force needed).
3. Paper Chromatography.
4. Barkhausan Effect.
5. Gauss Effect and Electrolytes.

Portrait Gallery

Portraits of 30 foreign scientists in black and white and a dozen Indian Physicists (in colour) have been prepared by the members of the Science Club. Biographical sketches have been appended.

Science Exhibitions

The Physics Circle of the Science Club organises an exhibition every year. We also participate in the (i) District Science Fair, (ii) The Regional Science Fair, (iii) The State level Science Fair, (iv) The Vigyan Mandir Competitions, (v) The activities of the Jawahar Bal Bhavan, (vi) The All-India Industrial Exhibition, (vii) The State Science Teachers' Association Programmes, etc., every year.

Our school took a leading part in organising the State-level Science Fair in 1968 and in the Science Corner of the Jawahar Bal Bhavan when the latter was inaugurated by the Prime Minister.

Our Science Cub has bagged many an award in the various Science Fairs and Exhibitions.

We are proud to report that we have received approbation from the UNESCO placing on record the good work being done by the Science Club.

Language Laboratory —An Experiment

S. Keshava Murthy

Introduction

On July 1964, I entered the school in which I am at present working as a Hindi Teacher. When I saw the Hindi textbooks 'Kavyasankalan', 'Gadya Sankalan' and 'Galpa Ekadashi', I felt very happy with the prospect of utilizing my literary knowledge to satisfy my inner urge by teaching these books. But when I entered the classroom to teach, it was a great disappointment for me because students were not as good as I had imagined. Though I had five years' experience of teaching at Dakshin Bharat Hindi Prachar Sabha, Mysore, the students here were entirely different. The good old methods of teaching were not applicable here and I did not know any other method because I was a fresh post-graduate without a B.Ed., degree. There was no body else in the school to help me in my work. Within two or three days I analysed the problems of the students and decided to take some steps as I felt that teaching Hindi in this school was a challenging job and I was to face this challenge myself.

The students here belonged to non-Hindi speaking area and were drawn from the local schools, where they had studied some books on fundamental Hindi. Some students were not even familiar with the alphabets of Hindi. But in our school the standard expected of students in Hindi was very high. Filling the gap between these two extremes was really a gigantic task. Ninety-five per cent of the students who offered Hindi as mother-tongue actually had different mother tongues like Tamil, Telugu, Malayalam, Coorgi, Sindhi, Marathi, Konkani, Bengali and Urdu. As there was no provision in this school to teach these languages as mother tongues, the only alternative left for these students was to select Kannada or Hindi under their first language. For them both were foreign languages. Many parents preferred Hindi for their wards, because it was going to be the official language. Under the circumstances I had to start with the fundamentals in Hindi and then had to take them to the beautiful gardens of Kavya and Gadya Sankalans published by the National

Council of Educational Research and Training, New Delhi.

The students were in VIII and IX standards. At the end of standard XI, they had to appear in an examination held by the Central Board of Secondary Education, an examination conducted exclusively for the four schools under the Multipurpose School Scheme. It was a problem for me to pay special attention to this problem-group when I was having a teaching load of 35 periods per week. I started teaching them the alphabet. By narrating simple stories in Hindi, I was trying to develop the listening skill among the students as it was not easy to do a good work in the class without it. Story-telling came to be a great success in attracting students and creating in them an interest in Hindi. For about two months, I adopted this method as a consequence of which, whatever I spoke in simple Hindi my students were able to follow easily. Now the students also gained confidence both in me and in the language. Except this I had no other language materials to develop the language ability in Hindi among the students, whereas a number of materials were available on the teaching of English. I read all the materials, available in our library, on English teaching and tried to adopt those ideas in teaching Hindi wherever possible. I felt that Hindi was lagging behind in this field. Therefore, I decided to prepare a language laboratory in Hindi so that I could face the challenging task with more confidence. The Head of the Institution was kind enough to sanction a sizeable amount to the school library for the purchase of good Hindi books for beginners as a first step towards the formation of the "Language Laboratory." Thus I selected about 350 good books on children's literature in Hindi.

Nature of the Language Laboratory

Language is the best medium through which we express our thoughts to others and thus communicate with one another. It should be the endeavour of every one of us to use this medium in an effective manner. Most of us are aware of the difficulty of the students in expression, either written or oral, and this is more so with the present day students. It was my experience that students were able to understand what I spoke but many were unable to express what they knew in simple and correct Hindi on their own, when they were drawn for conversation. Of course, their vocabulary was limited. I wanted to help them improve their vocabulary as well as their expresssion. I thought that "Language Laboratory Cards" were the best media which could improve their Hindi reading performance both in rate and in comprehension. One full year was devoted to the preparation of 'Language Laboratory Cards' in Hindi. I borrowed books on children's literature from all possible sources in Mysore City. I got a number of good books. I read nearly 500 books from the point of view of a child and selected about 200 interesting thoughtful stories, incidents, descriptions, scientific information and latest inventions. Based on their difficulty level and length, I divided those 200 passages into two sections. The passages having 160 to 240 words went into the category of 'small language laboratory cards' and those having 350 to 900 words were categorised as 'big language laboratory cards.' The 'small' and 'big' cards were distinguished from one another, The small cards consisted on multiple choice questions only, whereas the 'big mards consisted of 50 objective based new type questions. The aim here was to improve their comprehension ability. The cards were ready to be administered on students.

As it was an experimental project, I prepared the first 100 'small' cards keeping in mind the standard of the students whom I had to expose for this. Thus these cards formed part of a language laboratory in Hindi. It was not similar to laboratories in Physics, Biology and Chemistry which have a large equipment mostly technical in nature. This was a small experimental mobile sort of thing, full of cards, intended to meet the challenging needs of students who had come forward to learn a language about which they were not familiar.

The laboratory moves from class to class in search of the students. In this laboratory students experiment with language by combining the letters and adding prefixes and suffixes. Here the students 'Rediscover' the words, phrases and sentences through usage. Through this experiment students acquire the ability of reading, writing and speaking. They develop command over the language. Indirectly students learn the rules and regulations of gender, number, case-ending, etc.

Further, I classified these 100 small cards into ten units. Each unit had ten cards of similar nature of subject matter. While grading the passages I had kept in mind, the connection of S–C–S–R– (spaced, controlled, significant and repetition) bond. I was very careful in maintaining the interest of the child by bringing novelty, simplicity and utility. I tried to avoid passive vocabulary from the passages as far as possible. It can be seen that these passages were not prescribed ones, but they were within the sphere of the syllabus. Some of them furnished up-to-date information like Gemini Space flight, sputnik, soyabean, etc. Therefore these were expected to be interesting from the point of view of the students.

CONTENTS OF LANGUAGE LABORATORY CARDS

Unit	*Topics*
I	Moral Stories.
II	Incidents full of Knowledge.
III	Our Country and Ways of Life.
IV	Agriculture.
V	Astronomy.
VI	Indian Festivals.
VII	Wonders of the World.
VIII	Gift of Science.
IX	Secret of Nature.
X	Birds, Animals and Poems.

Objectives

The objectives of the language laboratory cards are:

(1) To help students acquire the knowledge of (a) elements of Hindi language, (b) different forms and styles of writings in Hindi.

(2) To enable students to form words with the help of prefixes, suffixes, inflexions (number, gender), phrases and idioms, punctuations and abbreviated forms.

(3) To help students develop their vocabulary through antonyms, synonyms and homonyms.

(4) To help students, comprehend what they read in simple and correct Hindi.

(5) To help students appreciate simple poems in Hindi.

(6) To help students read silently and improve the reading rate.

(7) To help students develop interest and desirable attitudes towards Hindi.

Procedure

For this experiment I selected students of standard IX (first language) on 1st September, 1966, because I could be in contact with them for three years, the period for which the experiment was to be conducted. The class consisted of 29 students, out of whom 27 had their mother tongue other than Hindi. Therefore, their rate of reading and comprehension was very poor. First of all I aimed at comprehension and not on speed. Each student was given a copy of the card of the first unit. I used to give five minutes for silent reading to each student so that he/she could read once or twice. After they finished reading, ten minutes were given for them to answer the questions. While answering, students were asked not to see the cards again. They were even prohibited from seeking the meaning of such words either from me or from their friends. They had to depend upon their own knowledge. On the basis of context they had to find-out the meaning of those words themselves. Like this they were enabled to gain self-confidence. After finishing the answers, they were asked to exchange the answer sheets with one another. Correct answers were read by me and students corrected the answer sheets of one another. After the correction work, I asked all those, who had answered wrongly, as to why they did so. After getting the reason, I corrected the concerned student explaining as to where and why he/she was committing mistakes.

Discussions were lively and students were encouraged to come out with their thoughts freely and frankly. Like this three or four cards were given to the students per week. Thus I finished 50 cards of 5 units in IX Standard. In the same way other 50 cards were finished in X standard by December, 1967.

After completing one card every day I used to draw individual progress, graphs and charts to represent their progress. This made the students evince keen interest in this project.

To test the reading rate among the students, I selected short passages from among the cards themselves and asked the students to read aloud for three to four minutes after the completion of each unit. I calculated the speed rate in terms of words per minute. This helped me to infer later that the rate of reading had increased considerably.

Achievements

Apart from individual progress graph and chart, I also used to draw graphs to show the position and progress of the class as a whole each month. I also prepared the comprehension builder and rate builder charts and graphs on the basis of the test (a) at the commencement, (b) after unit V and (c) after unit X.

'Reading comprehension builder' showed a tremendous progress. Gain ranged from 10 per cent to 60 per cent. In some cases progress was doubled. All showed progress except a few who seemed to be going down in the middle.

Reading speed rate builder chart also showed very good progress in reading rate even though my main objective was not to increase the reading rate. Gain ranged from 24 to 73 per minute. Four students gained double reading speed. Some of the students, however, seemed to be going down in the middle.

This experiment showed some striking results. The class average in comprehension at the beginning was 41 per cent and it showed a remarkable increase of 34 per cent at the end, thus making a net average of 75 per cent. In addition, the class average in speed rate was 150 words per minute as against 102 words per minute in the beginning. During the process of this experimentation the students learnt to use effectively about 1,500 new words which were added to their vocabulary.

As far as the time spent by me over the entire experiment is concerned the following figures speak for themselves :—

(a) The total duration of the process of planning, organisation and execution of the 'Language Laboratory cards' was of three years duration.

((b) About 1,500 man hours were spent in the preparation of the language laboratory cards.

(c) Administering the cards on the students and drawing of graphs and charts consumed about 200 man hours.

(d) Each student on whom these cards were administered had spent about 50 man hours during the two years of this experiment. (Please see the note in Appendix).

The out-come of this experiment was very encouraging. I administered only 30 cards on standard X students. In 1968 they took the Central Board Examination and 68 per cent passed in Hindi whereas in 1967 the pass percentage was only 28 per cent. Experimental batch of standard IX appeared for the same examination in 1969 and 90 per cent of them passed. At the same time I administered only 30 cards on standard X second language students. They secured 100 per cent results and 80 per cent of the students secured above 50 per cent marks. 73 per cent was the highest marks secured by a student. On the basis of the results it may be concluded that 'Language Laboratory Cards' definitely played a significant role in bringing about better results.

Thus, I can conclude my experiment by saying that I have a firm belief in these 'Language Laboratory Cards', which improve the reading rate and comprehension of the students.

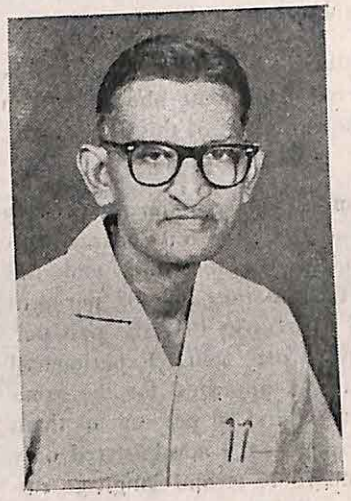
Suggestions

Hindi teachers of Southern States (Kerala, Mysore, Madras and Andhra) are facing the same type of problem in teaching Hindi. After standardization, if these cards are printed with colourful illustrations, on the basis of the theme of the passage, it will be more attractive as well as effective. So the Hindi teachers of other states can easily adopt these cards to meet this problem of teaching Hindi to students with different linguistic backgrounds.

Other teachers need not spend so much of time on these cards. On the administration of 100 cards, in two years duration, they will be spending only 50 hours, i.e., 25 hours in each year. These 25 hours could be fitted into the regular language time-table itself. Therefore it will not overburden the teachers. Each student can take up the responsibility of preparing his own progress graphs. Once in a month the class leader can prepare rate builder of the whole class. No doubt in the initial stages it may be difficult for the students, but they will evince keen interest in doing so, if we motivate them and give proper guidance. Thus the teacher can save his time.

Commerce Clubs in Secondary Schools

Gajmal Singhvi



In Secondary Schools, Clubs or Associations in different subjects are organised as a co-curricular activity. Commerce Clubs are a new venture to be organised in many Secondary schools. We have also started a Commerce Club in our school and I propose to give my ideas regarding the organisation, the objectives and the activities of such a club.

Organisation

Before starting the formal club it would be better if a congenial and suitable climate for its establishment is created by arousing the interest of students in some activities useful for them. For example the teacher enthuses commerce students to buy books or certain articles of stationery collectively for a group in order to get them at lower prices or organise a visit to a bank or a big commercial house to give them some practical experiences about their working and finally an interesting talk may be given to enthuse them to form a Commerce Club. During the talk some of the activities of interest that could be carried on in the club could be highlighted. When the students have been enthused for organising a Commerce Club the draft constitution (Annexure A) of the club, which the teacher should keep ready beforehand, be introduced and passed. The duties of the members of the Executive Committee be pointed out and students then be asked to elect capable students as members of the Executive. In the beginning the teacher may ask students to give a panel of names and the teacher may select if the students agree.

It is desirable that a small room be allotted in the school for the said club so that necessary record and material can be kept there. A nominal fee for membership should be fixed and a membership form be filled by members and the Secretary should maintain all records. Once a Commerce Club has been started, the membership fee should be collected at the time of admission along with other fees. A special Notice Board for Commerce Club or a Corner for Commerce Club be provided at a suitable place.

Aims and Objectives

(i) The club will aim at providing opportunities and facilities for its members for:

(a) recreation and entertainment.

(b) practicing all that has been taught in theory in the classroom.

(c) observing the procedures that are followed in the working of banks, insurance companies, different type of small and big commercial houses, factories, mills, workshops, railway stations, warehouses and shipping docks, and in government departments.

(ii) The Club will chalk out programmes for developing contacts with the heads and other persons of rank in Banks, Insurance Companies, Income Tax Departments, Universities, Colleges, Education Board and Department, Station Masters, Post Masters, Businessmen, Managers of Industries, etc.

(iii) It should undertake surveys about the type of population, occupations, living conditions, products and markets commodities in a particular village or area or locality.

(iv) It will run a Students Co-operative Store.

(v) It will aim at developing social qualities like honesty, responsibility, industry, co-operation, self-help, inculcate service motto and develop abilities to organise and manage its affairs with confidence.

Activities

Though Commerce Clubs exist in a number of schools yet if we look at the activities, we shall find that they are limited to one or two at the most. I have in mind a number of activities that could be easily carried on in a club to make it extremely popular.

1. *Recreation and Entertainment*

(i) The club should provide indoor educational games like 'Commerce' in which students will have the opportunity to recreate and to learn certain commercial terms and names like—Banks, Hotels, Tax Houses, payments, earnings, taxes, penalties, and enjoy the thrill of lending, borrowing, making profits and journeys and experience the stress, strain or pain of running losses.

(ii) The club should provide certain educational games in the shape of cards on which certain problems are specified and students are asked to give the solutions—or they are asked to detect wrong statements or figures. For example—there is a card showing a cheque with a certain deficiency, (e.g., the amount in words and figures do not tally)—the student is told to examine the cheque thoroughly and to say whether he would pass the cheque or not if he were a manager in a bank or a question could be asked: "Mr. X presented a cheque but the Bank refused payment, Why?"

A card states: Ram purchased 10 toilet boxes @ Rs. 5.15 each. The shopkeeper demanded Rs. 55.10. Should Ram pay this amount? If not, how much should he pay?

(iii) The club will arrange for its members commercial vocabulary games—some riddles or puzzles with solutions.

(iv) The club should provide facilities for staging dramas, or one-act plays for developing social qualities, such as honesty, taking vows not to drink wine or sell liquor, not to take bribe, not to adulterate—sacrificing every thing (specially money) for the sake of the country or for noble causes like helping the flood or famine-striken people; the natural calamities like earthquakes or eruption of volcanoes, lectures in local dialect stating the need for opening Saving Bank Accounts; investing money in Defence Bonds; purchasing swadeshi goods or how to start a co-operative society or why and how to become a member of a Co-operative Store or Society; not to take an exhorbitant rate of interest could be delivered.

(v) Cards asking students to make journeys from one town to another, and one country to another by rail, road, air or ship.

Here the student is asked to consult Railway Time-Table and to state the names of big junctions, the time the train would reach and depart, the halts they could make to buy certain things, such a game will enable the students to consult Railway Time-Tables, give the knowledge about routes and names of cities, etc.

(vi) Finding telephone numbers from a Telephone Directory Cards have real names beginning with different alphabets and of different cities.

(vii) Cards contain name, topics, etc., students are asked to arrange lists in alphabetical order, geographical or subject wise order or detect errors in the order of lists verifying the correct answer with the solution.

(viii) Cards contain questions for calculating wages, interest and converting money into Foreign Currency with the help of tables.

(ix) Game—Designing Letter Heads and Advertisements: As a game the students take out from a Pigeon Hole or Box a card containing all the particulars of a Business Letter Heading and he is asked in the card to design the Heading. When he has done so he may compare his design with the actual letter Heading. Here some students may practice only copying out Heading. Then at a later stage designing letter Heading may be taken up. To assist students in designing different kind of letter-design should be kept in the club.

Similarly, cards containing particulars of advertisements are placed in a Box or an Almirah along with actual drafted advertisements and students have to draft and design advertisements and compare their drafts and design with the actual ones.

(x) At times the members of the Club arrange parties on the annual day of the club inviting high officers, businessmen of repute, etc.

(xi) On the birthdays of the members, the Secretary and President of the club should send greetings and best wishes or even nominal presents to enjoin in the happiness and pleasure of the members.

(xii) Competitions in debates, essays, class-wise manuscript magazines, preparation of graphical, pictorial and other charts, instructional material, collections designing letter headings, etc., can be arranged as a regular feature of the club.

2. *Providing facilities to practice what has been taught in theory.*

To achieve this objective the following types of activities can be taken up.

(i) To give practice in business office routine work: Provide letter Receipt Books or Inward Registers; Dating Stamp; Outward Register; Despatch Books, Peon Book and Postage Book in the club. The students be divided into batches of five each with one leader. The leader arranges by turn the actual entries in these registers of all those letters received in the school, in the students Co-operative Store (if one has been started) in the Mock Business concerns, opened under the auspices of the Commerce Club. When students have learnt making actual entries they could be entrusted with the task of entering the letters in the receipt and despatch registers.

(ii) To give practice in the filling up of various postal forms such as M.O., Certificate of Posting, Telegrams, Cheques, B/E., P/N, Invoices, D/N and C/N Statement of Account, A/S, etc. Some cards, giving particulars, are placed in different pigeon holes, e.g., Hole labelled M.O. Then there are cards stating 'Ram of Manak Chowk, Jodhpur wants to send Rs. 10.00 to his friend Murari, 15, Kishanganj, Kanpur on 11-12-1969. He also wants to send the message: "This is the repayment of the money I borrowed from you on 8-12-1969. I thank you for the money spared by you." Fill in the M.O. form correctly and go to the P.O. and send it.

Note: Remitter is the person who sends money. Payee is the person to whom the remitter wants to send money.

At the bottom of the form, you find the space for writing the message. Please write correctly the addresses and see that the amount in words and figures tally. In one of the Pigeon Holes are placed the M.O. forms—all these forms could be typed out or cyclostyled and kept for this purpose.

Post Office run by the club: A post office of the club is opened where those filled up forms are submitted. The postal authorities (the members—senior class students check these forms, take the money and commission are paid in the form of coupons issued). The money is then paid to another party of the club, receipt taken and acknowledgement sent back to the remitter.

Saving Bank. Members will open accounts with this Bank run by the club in the same way as is done in a post office and students will practise filling up deposit slips withdrawal forms, pass books, etc. Thus money will be actually deposited and withdrawn, and operation of accounts will be practised. Here both coupons and actual money transactions can take place.

(iii) For practising opening of accounts and transacting business with a Bank (Commercial Bank) a Students Bank be established where Mock Business Concerns will open current accounts. Money will be deposited and paid by the creation of Money Coupons of various denominations by the bank itself.

(iv) For practice in actual correspondence and business routine and maintenance of accounts, filing, indexing, etc., two or more Mock Business Concerns (without actual goods) be formed with a Manager, Accountant, Cashier, Inward and Outward Clerks. Salesmen, etc., and actual correspondence be carried on between them—one can be wholesale and the other retail one.

Side by side the following departments may also be established: Registration Department, Income-Tax Department and Sales Tax Department. With these the Commerce Club, and the business concerns will register their Constitution. Partnership deeds and if Joint Stock Companies are started, then Articles of Association and Memorandum of Association.

For Giving Practice in Card Indexing. Students can prepare Library Catalogue Cards which may be kept in Card Index Drawers. Stock Registers of Stores be kept on Card Index basis.

For Giving Practice in Filing. Students are asked to file letters of the Mock Business Houses first, then actual letters of the Co-operative Store and the letters of the school correspondence in actual office files.

For Giving Practice in Auditing. The club should appoint its members as auditors to check the accounts of the Mock Business Houses, Bank, P.O., and when students have got sufficient practice they should be asked to audit Students Co-operative Store and even school accounts.

For Giving Practice in keeping Stock Register. There is sufficient scopt for doing practical work in the Consumer Co-operative Store—for actually writing school bills in school Stock Register under the supervision of the concerned clerk.

Note: First students be asked to audit the Co-operative Store Stock Registers as well as the School Stock Registers.

For Giving Practice in Preparing Parcels for Despatch. The members should first be allowed to observe all such parcels and bills or Invoices received and then they may be asked to pack their own books or clothes or glass utensils for despatch. In order to give them practice they could be provided with games material or maps or Exercise Books meant to be destroyed for packing purposes so that they get practice in packing and preparing packets for actual despatch, checking and reporting. Practice in Actual Typing out Letters, Bills, Invoices, Notices: Practice in typing the above automatically take place when the club runs so many varied activities—all forms shall be typed out, stencils cut and cyclostyled by commerce students, if typewriting is one of the subject and if a duplicator is available in the school.

Practice in the Working of Calculating Machines could be given as a Club Activity.

The Co-operative Store. In addition to the above stated practices, the Store will provide opportunity to the students to practise actual Salesmanship and to work as auditors, cashiers, accountants, Managers, Correspondence Clerk, etc., in fact, actually running a shop on a small scale. Lastly, the Club must organise activities to enable its members to practice all aspects of Commercial Concerns.

3. *For Enriching Knowledge and Providing Opportunities for Observation of Procedure in the Working of various Institutions and Departments.*

For this purpose visits should be organised to:

(a) *Post Office*: or Head Post Office with a view to enable students to observe hours of work, various departments of post office counters such as Registration, Parcel, V.P.P., M.O., Insurance, Certificate of Posting, Post Restante, Telegrams, Telephone, Savings Bank, Radio Licence, Window Delivery, Letter Boxes. Let students observe sorting, datting, packing, sealing mail bags. Those who have never telephoned be given opportunity to talk on the telephone and enjoy the thrill of it.

(b) *Banks*: Students observe here the various counters, how money is deposited, how payments for cheques are made—the process a deposit slip or a cheque has to go through, the various forms used by bank, how entries in the Account Books are made, how daily books are tallied, System of Lockers, etc.

(c) *Railway Station.* Students will observe how goods are accepted for despatch, how delivery is taken, how do people get their luggage booked—the various type of packing material used, labelling, marking, the R/R, the Forwarding Note, its filling, receipt giving, loading and unloading of goods, godowns for storing, the watchman system, etc.

(d) *Co-operative Stores.* Super Market —students to observe the organisation and management of a Departmental Store—Salesmanship—system of sale, and issue of Memoes, system of payment—cheques, etc.

(e) *Commodity Markets, To Forward Dealing Markets*—how people transact forward deals, their recording, system of settlement of deals, etc.

(f) *Wholesale shops*—to observe the way goods are advertised—how stocks are kept, the variety in the same class of goods—the way accounts are kept—Mahajani System or the D.E. System.

(g) *Retail Shops*—to observe the show cases—the salesmanship—account books—stock books.

(h) *Factories and Mills and Workshops*—To observe the organisation aspect—the raw material—its turning into finished products in various process—the labour conditions—the office and its working—records about work of labourers—the use of Labour and Time Saving Devices.

(i) *Shipping Companies Offices and Shipping Docks*—to see how goods are prepared for export—the various formalities—how goods are loaded and unloaded—taxes realised—how goods are delivered.

(j) *Aerodromes*—to observe the formalities, the arrangements for bringing customers to aerodrome and for their halt, facilities provided to customers during the journey, the limits of luggage one can carry and the charges for extra luggage, etc., how passports and visas are obtained when foreign travel is desired.

4. *To Develop Contacts with persons holding High Offices in different walks of Life with a view to Enrich Knowledge.*

Talks. Talks must be planned every year. Talks by Railway authorities about Traffic Rules, Travelling facilities, open delivery, demurrage, opportunities of services in the railways.

Talks by Bank Authorities. A talk on Investments in Bank, the various services provided to the public—the bank rate Bank charges for various types of services—opportunities of services.

Talk by an Employment Officer. A talk about the various opportunities open to Commerce students for choosing their career.

Income Tax Officer's Talk. On necessity of Taxation, submitting of Returns—penalties if tax is not paid, rates of Taxation for different types of business concerns, etc.

Talks by Professors of Universities or Colleges. On Five-Year Plans, India's Commerce and Trade, Economic Policy of India —agreements with different countries re: Trade and Commerce, Foreign Capital, India's Debts, Need for earning Foreign Exchange, International Bank, Foreign Aid by different countries.

Talks by Industrialists. To tell about a particular Industry the difficulties it is facing —with labour, market conditions new innovations, etc.

Talks by Insurance Field Officer or Labour Leaders will also enrich their knowledge.

Sometimes Panel Discussions on curruent topics concerning commerce, Industry and Trade will prove useful.

Sometimes *Mock Parliaments* may be held and discussions actually carried on in the Parliament be reproduced before the members of the club.

Reading by members published essays from periodicals or newspapers is also a good and useful activity for the club to enrich the knowledge of students.

A special Board be assigned for writing Current Market Rates of Chief Commodities to apprise students about prevailing rates. A record of these may be kept in a Note Book and trends of Markets may be studied and the observation may be notified to the members. A group can be made responsible for this work.

5. *Other Activities*

Mock Interviews. Members of the club may be asked to submit applications for particular jobs and their interviews be taken by a board, appointed for this purpose.

Reporting. The students who have been assigned different jobs and responsibilities must be trained in preparing reports of their departments or jobs. Budget may be prepared and presented. Similarly annual Accounts may be prepared and presented.

6. *Surveys and Studies*

The Club may conduct surveys. For example the members may study the economic conditions of the village or particular area or locality in a city. They may go to the nearby villages to give some entertaining programmes on Saturday night and on Sunday, meet people through some known persons. They may take up various studies and surveys such as Population Study–No. of Houses, type of occupations, number engaged in each–their earnings, the products of the village and their quantities, how these are disposed off, the size of holdings, total number of shops, commodities that are sold, needs that are not met by merchants–No. of children going to school, to hospital or dispensary or health centre, working of the Co-operative Society, the Panchayat–the Panchayat Court, number of post-graduates, graduates, matriculates and the nature of employment sought by them, how many Unemployed–number of persons trading or working outside the villages No. in Military, in Navy, in Air, in Government Departments –number of persons doing money lending, the rate of interest charged by them.

7. *Annual Magazine of the Club*

This will encourage members interested in creative writing to write articles and to publish the working of the entire club activities with names of incharges, photos of the Members of the Executive Committee and persons doing responsible jobs, photographs of the members carrying on activities of different types, photos of visitors, etc., all these are bound to give encouragement to the activities of the club.

8. *Keeping a Library for the Club*

Here books published for Programmed Learning be kept besides other ones so as to enable students to form habits of self-learning and ensuring learning.

It might be argued that the activities enlisted above can be carried on even without forming a Commerce Club. We agree. Well some of the activities can be carried on even in the classroom, but in my opinion Club is a place where its activities should be so designed that every member is attracted to it and he comes of his own accord for recreation, self-learning, creative activities and doing real jobs. Moreover, the formation of clubs and running them, is a training in democratic methods. Let us have faith in the working of clubs and try out the various activities honestly and then enjoy the fruit of labour.

If activities as outlined above are started and the interest of students is aroused, various personal traits of character such as honesty, industry, responsibility, courtesy, promptness, accuracy, methodical working organising abilities, managing abilities and capacities are bound to develop. The teachers will get opportunities to observe and to develop these qualities among students. This gives the actual environment for understanding commercial practices. If suitable atmosphere is created the Commerce Club is bound to help the weakest to improve themselves and the bright to come out with better results. Not only will it improve examination results, but it will lay the foundation of many a business magnates.

ANNEXURE–I

CONSTITUTION OF COMMERCE CLUB

Name : COMMERCE CLUB

Aims and Objectives :

1. To provide opportunities and facilities for :
    a. Recreative and Entertaining Activities.
    b. Doing practical work in commercial Practice and Book-Keeping by starting Mock Business Houses and by engaging in School Office and Co-operative Store.
2. To enrich knowledge by organising visits to Commercial and Industrial Centres, etc., and inviting visitors to give talks.
3. To run a students Co-operative Store.
4. To take out and publish an Annual Magazine.
5. To conduct studies and surveys of nearby villages, localities and areas.
6. To take up social work, relief work and educational work.
7. To organise annual exhibition, parties, excursion.

Membership

There will be Patrons, Honorary Patrons, Supporters and members.

Member : Any commerce student of the school can become a member of the club. He will fill in the membership form and pay a fee of Re. 1 as annual fee.

Patrons : Those persons who will pay Rs. 100 will be called Patrons.

Hon. Patrons : The Commerce Teacher of the School or any other teacher interested in Commerce Club activities shall be its Honorary Patron. The Executive may appoint any person whom it deems proper as Honorary Patrons.

Supporters : Those who pay Rs. 25 to the Club shall be called Supporters.

Executive Committee : The Executive Committee will consist of.

1. President, 2. Two Vice-Presidents, 3. Secretary, 4. Two Joint Secretaries, 5. Treasurer, 6. Four Members.

All the office-bearers except the President and one Vice-President and one member shall be elected by the members of the Club annually in the month of July or the First of August every year.

The Head Master of the School shall be ex-officio President of the Club.

The Commerce Teacher nominated by the Headmaster will be Vice-President and he shall attend all the meetings of the Executive and will preside in the absence of Headmaster. Another teacher will also be nominated by the Headmaster to work as member of the Executive.

Functions of the Executive

It will plan and organise the various activities to achieve the aims and objectives of the Club.

Meeting : The Executive Committee will meet at least once in a month.

Duties of the Secretary

1. To make correspondence on behalf of the club.
2. To organise activities as chalked out by the Executive.
3. To keep the proceedings of all meetings and to report them in the next meeting.
4. To present to the general body the annual report about the activities of the Club.
5. To make purchases as authorised by the Executive after taking sanction of the Commerce Teacher (Vice-President).

Duties of and Powers of the President

1. He shall preside at the meeting of the General Body and the Executive Committee.
2. All decisions taken by the Executive will be valid only when the President has approved them.
3. All bills shall be valid for payment when countersigned by him.
4. The President will have the right of disallowing any activity, decision of the Club when he deems necessary without assigning any reason.
5. The President can incur an expenditure of Rs. 25 at a time.

Duties of the Joint Secretaries. To assist the Secretary in his work.

Duties of Treasurer: To receive all money on behalf of the Club.

1. To keep an account of all receipts and expenditure.
2. To make payments after the approval of the Vice-President and the President.
3. To prepare the Budget and get it passed by the Executive Committee.
4. To present the audited Accounts at the Annual Meeting.

Note: All money received shall be deposited in the School office.

Activities of the Commerce Club

1. Educational Games.
2. Staging Dramas, One-Act Play.
3. Visits to Com. and Industrial Centres to be organised.
4. Inviting Visitors to give talk.
5. To run a Co-operative Store.
6. To establish and run Mock Business Houses, to establish Mock P.O., Mock Banks, Government Departments.
7. A library to be owned and to arrange issuing of books and magazines, etc.
8. To publish annually a Com. Club Magazine.
9. To encourage students to prepare exhibits and instructions, parties and to arrange exhibits and instructional material and to arrange exhibition.
10. To organise excursions, parties, competition and to take up all those activities which will cater for the fulfilment of the aims and objectives.

Annual Meetings. In August every year with 3 days notice.

Group Dynamics in Education with Specific Reference to the Teaching and Learning Process of English

J. S. Choksi

ONCE a teacher who was teaching English came to me and complained, "The students of my class do not read well, nor do they spell the words rightly. How can I teach them? How shall I be able to complete the course of the year?" I appreciated the sincere concern of the teacher and promised to visit her class. As I felt this to be a challenging situation, I visited the class on the very next day. I told the children about the deep concern and worry of the teacher for them. I asked them, "Will you all help us in finding out the causes for deteriorating standards in English? How shall we tackle this situation? Shall we plan to overcome this impasse?"

There was dead silence. There was no answer from the class. I again appealed, "Please, help us". There came a voice, fragile and feeble. "Sir, spellings are difficult." Slowly the class was reacting, "Pronunciations are difficult." "We do not like to read." "We follow and understand our teacher but we cannot answer or express ourselves in English." "We have less time to read at home." Slowly the rapport was being established. "Let us make plans to learn spellings and to have its practice with some of our friends in the class," came a suggestion from a few students. It was a nice suggestion. The class was divided into small groups of four or five students, to drill spellings and to practice reading. After a week the class was humming happily with gay and glittering faces. The students were having the happiest hours in the school. They were busy with a kind of group-work, wherein a living and sustaining force, which kept every child busy for days together, was let loose. The students were participating freely and were nicely involved, as the whole plan was the result of the team-work. This was our humble beginning. With the passage of time, we tried to refine our approach and with faith in the dictum of the great philosopher, who said that education consists in constant reconstruction of experience,[1] we are still trying to make it more scientific and worthy of the name of group dynamics.

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[1] J. S. Brubacher, **Modern Philosophies of Education**, p. 2, New York : McGraw Hill Book Co., Inc., N.Y., 1950.

What Does It Mean ?

What is group dynamics ? How does it affect the teaching and learning process ? Group dynamics lets loose a kind of power, generated through interaction and participation of individuals in a group. 'Group dynamics deals with the psychological structure of groups, the process of group change, decision making, group leadership, learning and thinking in groups.[1]

Psycho-Pedagogical Basis of Group-Dynamics

Group-Dynamics and Behaviourists. From the point of view of Behaviourists like McDougall and Tolman every type of behaviour is purposive. It is geared to some definite ends or goals. No individual can escape from the necessity of setting up ends. Do our human ends not exhibit group character ? An end or a goal is not something external to activity itself; it is a habit arising out of the need of an individual to adjust himself to his group. Thus group dynamics is inherent in the minds of men.

S-R Bonds and Group Dynamics. Psychologists like Thorndike and others say that learning is connected. 'The mind is man's connecting system.' Learning takes place when a connection in the nervous system is established between stimulus and response. Does not individual get involved when he worked in a group ? He gets very many opportunities of responding to varied stimuli. Common purpose and common goal of the group leads to strenuous efforts to reach the goal. Interaction and participation in the group will bring in its wake more and more S–) R activity. Should not conclusions–learning–effected through such an approach be stronger, when S–) R bonds are instituted on well discussed footings ?

Gestaltrists N *Group Dynamics.* According to Gestalt Psychologists, organization and reorganization are constantly occuring as the individual interacts with one's counterpart in a group. Through group discussions the individual not only gets the real picture–'pattern' or configuration of the whole but he gets real insight. Clear perception and insight motivates the process of learning. Interpersonal tensions that would interfere with the easy process are reduced. 'Learning in groups seems to be superior to learning in isolation,[2] Stimuli are not mechanically responded to but they are responded to with understanding, as every individual is an active participant. Segal leads us to give premium to group dynamics by suggesting that 'the process by which one must consider other individuals in a group and a problem at the same time, not only tends to increase insight and understanding of the problem, but also creates a situation in which the individual has practice in bringing about emotional balance.[3]

Transfer of Training and Group Dynamics. Group dynamics indirectly helps transfer as it brings insight to the participant in a group. If the individual gets good insight into and understanding of a subject, the transfer effect will be better. The narrower and shallower the meaning, the less will be the transfer. The deeper and comprehensive the meaning, the greater is the transfer. 'Organise the learning of a subject as an attack upon real problems, a process of exploration and discovery, and a progressive emergence of understanding, the transfer will take care of itself. Richly meaningful learning transfers by its own momentum.[1] Katona believes that 'much more transfer value is possible when material is learned in an understanding manner.[2] McGeoch stresses the same point, "where the subject sees into the fundamental relations of a problem or has insight, transfer seems to be a major contributing condition."[3]

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[1] J. B. Bonner, **Group Dynamics, Principles and Applications**, p. 235, Ronald Press, N. J.

[2] A. I. Gates, **Educational Psychology**, (3rd Edition, New York : The Macmillan Company, 1948).

[3] D. Segel, **Frustration in Adolescent Youth. Bulletin No. 1.**, 1951. (Washington, D.C. : Office of Education, Federal Security Agency), p. 48.

Need of the Hour

Will this approach of Group Dynamics be not conducive to our Indian atmosphere? The fact that our nation has decided to make Indian Democracy progress on the socialistic pattern of society, impresses upon us that our conception of democracy be less individualistic and that it should have a greater social emphasis. Philosophically it takes its origin in the nature of society as communication and co-operation, as it was visualised by Mahatma Gandhi. Some exponents of this philosophy believe that, 'the society not only exists in communication, but it continues to exist, it perpetuates itself by communication.[4] By communication and free participation the students feel involved in and concerned with a group, in solving a problem. Sharing becomes the norm of the little group. On one hand it shares the largest number of variety and purposes between its own members of the group and on the other hand shares similarity with other groups. Bode has rightly said, that 'it continually endeavours to widen the area of shared concerns to grow in sharing.'[5] As the suggestions and opinions of the individual are accepted he feels to be recognised in his group. Dignity of his individuality is maintained and he feels himself nicely involved in the group work. This sense of belongingness in its turn leads the students to respect and honour the common code of behaviour in a group. Discipline is maintained from within rather from without. Thus Group Dynamics stresses the idea that education must be concerned with human relations.

Is it not the need of the hour to make our democracy a thinking democracy? 'A workable democracy is a thinking democracy. People must be reflective and must prize individuals who think hard and clean if demoracy is to strengthen.'[6] Does not Group Dynamics make the group member to think?

Group Dynamics leads us to democratic teaching. Wider opportunities of free participation and interaction in a group, educates our young generation to develop democratic values of life. Kothari Commission has aptly recommended that 'special emphasis has to be laid on the development of democratic values of life, such as scientific temper of mind, tolerance, respect for the culture of other groups, etc., which will enable us to adopt democracy not only as a form of government, but also as a way of life.[7]

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[1] J. L. Mursell, **Successful Teaching—Its Psychological Principles,** (McGraw-Hill Book Company, Inc., Tokyo, Second Edition), p. 63.

[2] G. Katona, **Organising and Memoirsing** (Columbia University Press, N.Y. 1940), Chap, 5, pp. 128-136.

[3] J. A. Geoch, **The Psychology of Human Learning,** (Longmans Green & Co., New York, 1942), p. 446.

[4] Brubacher, J. S. **Modern Philosophies of Education,** (McGraw-Hill Book Co., N.Y. 1950), p. 124.

[5] B. H. Bode, **Progressive Education at the Cross-roads,** (Newson & Co., N.Y., 1938), pp. 104-113.

[6] Lewis Burnett, **Re-examination of Democracy in the Classroom,** (Childhood Education, Jan. 1963, p. 217. (A. C. E. International, Washington, D.C.).

[7] **Report of the Education Commission, 1964-66,** Ministry of Education, Government of India, p. 17.

Such a freedom of thought and action in our class-rooms and school systems guarantees the maximum amount of self-actualisation of every student. Under such circumstances there will be very few problems of maladjustment among our school population.

With such a broad conception of Group Dynamics we will never fail to appreciate the fact that, 'instead of meaning just one thing, democracy appears to mean at least 4 different things to us—respect for the dignity of man, equalitarianism, freedom and sharing.'[1]

Relevance to the Process of Teaching and Learning English

How does Group Dynamics help us in the process of teaching and learning English? Is it possible when English is to be taught as a foreign language? How can it help the children when they have not developed the capacity to express themselves in English? Will it be possible for a teacher to cover and to complete the courses prescribed by the State Department?

Of all the school subjects, language gives ample opportunities for group sharing and collective learning. Language being the man's most basic tool and media of communication, thinking and reading, it should be taught in groups and teams. Language is used in social situations. For children to have adequate experiences in the use of language, the group must operate together.[2]

Aims of Teaching English

Considering the aims of teaching English[3] a pupil should be able to (i) understand spoken English within the structures and active vocabulary prescribed, (ii) to read his text-book aloud with expression, understanding and correct pauses, the pronunciation and intonation being fairly accurate, (iii) to understand written English with an active and latent vocabulary of about 600 words; (iv) to translate correctly into the mother-tongue a passage from the text; (v) to use 400 words from the active vocabulary prescribed, (vi) to answer in simple and compound sentences questions arising out of the prescribed texts, (vii) to describe a familiar object in about five simple sentences, (viii) to write English in a good hand in Print Script

Most of the teachers in Gujarat believe that these aims are not fulfilled satisfactorily and that the courses are completed very hurriedly. To fight against these anomalies Group Dynamics is one of the soundest and safest approaches.

Oral Work in English by Group Dynamics Approach

For the first five or six weeks of the course, the book should not be in evidence at all, and that the first twenty-five structures prescribed be introduced through oral work only.[4] Under these circumstances, Group Dynamics approach will be of great help to all.

How can we make use of Group Dynamics approach to introduce the alphabet or words? A list of content words may be made. If it is based on Thorndike's First Five-Hundred words of Mrs. Mandakini Amin's research,[5] it will be of great value. Flash

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[1] J.S. Brubacher, **Modern Philosophies of Education**, pp. 143-144, (McGraw-Hill Book Company, Inc., N.Y., 1950).

[2] W. T. Pretty, **The Language Arts in Elementary School**, (Prentice Hall of India, New Delhi, 1965), p. 13.

[3] A Report of the **Committee to Re-examine the Present Syllabus in English**, (Published by the Government of Gujarat), p. 15.

[4] H. A.D'Souza ad R.D. Desai, **Teacher's Handbook for Modern English Readers**, p. VII. (Karsandas Narandas & Co., Surat).

[5] M. Amin and M. M. Chauhan, **English Words Assimilated into the Gujarati Language. A Pilot Study**, (C.A.S.E., M.S. University, Baroda, 1966).

Cards may also be prepared of the pictures of the respective words.[1] The work sheets based on the content words may also be prepared and cyclostyled for discussion.[2] After a formal introduction of the content words by the teacher, the group-work should follow in the following ways, through group-participation and discussion in the groups of four or five students.

1. Recognition of alphabet in relation to pictures with the help of flashcards or pictures.
2. Making a collection of pictures of similar alphabet, (viz., Apple, Ant.).
3. Making a collection of pictures of words of similar phonetic value, (viz., Bat, Hat, Rat).
4. Colouring the alphabet as well as the pictures.
5. Telling a sentence on a picture, (viz. This is a bat).
6. Finding out similar meaningful words of equal phonetic value. (**Ten, Pen, Den, Hen.**[3])
7. Word building through tables.[4]

The same approach may be followed in introducing and establishing the sentence patterns and structures of English speech. Thus the objectives of oral comprehension and oral expression will be more meaningful and successfully achieved. Here we should remember that the subject matter is a means to an end. The use of language for expression and comprehension should be the aim of language teaching, while the information given in the lesson should be treated as a by-product.[5]

Developing Reading Skill by Group Dynamics Approach

To develop the reading skill (Objective No. 2) the pupils are first led to the reading of words and sentence patterns. This should be followed by reading in small groups. This will give maximum time to all the students for practising reading under the guidance of the group leader. Every flow or slip is so criticised or improved upon by the members of the group that drilling of words and structures as well as fluency in reading the material will be gained. Reading in groups should be preceded by careful introduction of new words otherwise a slight flaw in pronunciation will multiply 40 times in the class. The teacher's role is to make his advice and suggestions available to all the groups. The strategy for this may be as follows:

1. The class may be divided into sizeable groups.
2. Model reading of words or sentence-patterns may be done by the students.
3. Model reading should be followed by reading of the same material by a few gifted students before the class.
4. Group-work in reading the prescribed reading material.
5. Group-work in reading unseen reading material based on the controlled vocabulary.
6. Reading through the tables.

Expression and Comprehension by Group Dynamics Approach

But shall we feel satisfied with the mechanical reading of the said material? Reading is not just saying the words in a list. Critical reading cannot be attempted in a vacuum. The teacher should encourage students to be involved in the planning of Reading. He may invite a few questions from each group to be answered. These questions should be either cyclostyled or be written on the black-board. This will make the group-work more interesting as they have been either challenged by the other groups to find the answers of the questions or they have to find out the answers of their own questions. Any way, the reading will be critical as well as meaningful. This will serve a double purpose written comprehension as well as oral expression by the reader. This type of critical reading differs from mechanical reading. Here it is recognising accurately, comparing carefully, analysing systematically and evaluating thoughtfully.[1] Thus the objectives of reading his text-book aloud with expression, understanding and correcting pauses; understanding written English and answering the related questions in simple English will be fulfilled.

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[1] See Appendix 1.

[2] See Appendix 2.

[3] See Appendix 3.

[4] See Appendix 4.

[5] C. Padmanathan, **Help the Pupil to think for himself,** N.I.E. Journal, May, 1968, p. 19.

With this type of Group Dynamics approach in fulfilling the above-mentioned aims, the cold formalism of traditional class-room is replaced by an atmosphere of democratic freedom and activity, and the seed of creative talent spurts out and grows into a healthy plant.[2]

If such a creativity is the result of the Group Dynamics approach, will it not breed dynamism in other fields of learning English ? A distinguishing feature of a dynamic society (group) is its belief in creativity and its efforts to release and stimulate the creative impulse of its members.[3]

This type of creativity generated by the mutual discussion in the group may well be tapped in encouraging students for written expression.

Written Expression by Group Dynamics Approach

To develop written expression we have to bear in mind two objectives; the mechanics of writing and coherent presentation of ideas in simple English. The mechanics of writing may be taught by the teacher but drill work may be done in groups, with the help of graded assignments and tables. The coherent presentation of ideas will be made by the students as they have fairly mastered the vocabularly as well as sentence pattern during their group work. Group-work in controlled composition; writing 5 to 7 sentences on a topic may be done in the group. Discussions in such a group work may be based on the table or points about the topic. This makes the work lively and the written expression will be more systematic and coherent.

At a later stage in addition to the points for the topics on which the students are expected to have group work in written expression, selected vocabulary, phrases or usages may also be suggested for use in their written expression. This will neither mar the originality nor curb the imagination but will arm the students for future use and artistic expression, because at the discussion stage; the group fully takes grip and tries to institutionalise the usages. When the students are familiarised with such a type of group work, they will have better insight in the subject, which will result in creditable imagination and creativity. Such creative imagination is the necessity of the nation, because, 'future of our civilization, our very survival depends upon the quality of the creative imagination of the next generation.[4]

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[1] David H. Russel, **Critical Reading: Teaching** Education; (N. C. E. R. T., New Delhi, January, 1964), p. 82.

[2] A. V. Devegowda, Editorial, **Teacher** Education. April, 1964, (N.C.E.R.T., New Delhi), p. 161.

[3] Asheshiengar, **Promotion of Creative Self-Expression among high school Pupils.** Teacher Education; April, 1964, (N.C.E.R.T.) New Delhi.

[4] E. Paul Torrance : **Guiding Creative Talent;** Bureau of Educational Research, University of Minnesota.

Pre-requisites in Group Dynamics

Groupings. In Group Dynamics approach there are ways of forming groups. No one factor is an adequate criterion for forming groups. All of the following are criteria for group formation appropriate to some purposes: ability groups, friendship groups and interest groups. These factors or the combination of them will be appropriate in forming the groups. Sociometrics gives us a way of forming groups along friendship lines without any one being left out. The sociogram will always enlighten the teacher to change the groups or to rearrange them. The true alternative to big, rigid organisations, cramped by their self-imposed routine is to limit the number of people in the group and to multiply and federate these groups.[1]

School Buildings. Our school buildings need no alterations or additions. The only care that we should take is to provide for enough room in the class for free movement. School buildings are the stage setting for a good curriculum. Group planning and action are hampered when 45 children occupy space planned for 30.[2] In rural areas trees will give enough space. The only addition which the school will have to make is the purchase of a few carpets.

Seating Arrangements. What should be the seating arrangement? Though it does not require any alterations in the present school buildings, I do not approve of the present seating arrangement in the classroom. The present system in India of a table and a chair being arranged before the benches of students is the most conservative one. It is an authoritative arrangement conforming to the old dictum, 'Thou shalt hear me.' In Group Dynamics approach 'the wise teacher will place his desk so as to be a part of the group rather than in front or on top of the group.[3] Circular arrangement of seating and group work permits the optimum of communication and the minimum of friction and contention.[4] Our major purpose in having such arrangement is to help young students learn to think together on problems of common significance to them. Seating arrangements markedly affect patterns of communication. Flexibility of arrangement is essential to such an approach in our school systems. Provision for flexibility or for lack of it symbolises the community's concept of human adjustment, its answer to the question 'Are people to manage and to arrange the conditions of their living or are they to learn to adjust peacefully to whatever conditions are provided for them?[5]

Qualities of Living in Groups. What are the important qualities of living in groups that are needed for each member of the group and for the group as a whole? The dynamics of growth in every group are growth from

(i) hostility toward more and more acceptance,
(ii) insecurity toward more and more security,
(iii) inadequacy toward more and more adequacy.[6]

Financial Implications. What are the financial implications of the Group Dynamics approach? The financial implications will be hardly anything more than getting flash cards, sentence patterns, tables for language learning, assignments, etc., cyclostyled on fine card-boards and duplicating papers. This approach will require more of enthusiasm and zeal and ensure democratic spirit, work and play in the classrooms.

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[1] Lewis Mumford, **The Conduct of Life**. (Harcourt Brace & Co., New York, 1955, p. 277).

[2] Kate Wofford, **Setting the Stage**: (Childhood Education, March 1954, p. 303).

[3] Howard Lane and Mary Beauchamo, **Human Relations in Teaching**, (Prentice-Hall, Inc., N.J., 1957, p. 324).

[4] **Ibid.**, p. 330.

[5] Howard Lane and Mary Beauchamp, **Human Relations in Teaching**, (Prentice-Hall, Inc., N.J., 1957), p. 323.

[6] **Ibid.**, p. 330.

Evaluating the Process of Group Dynamics

How can we evaluate the quality of Group Dynamics? The following check-list may be used as a self-evaluation form to measure our success.

1. Are the purposes common to the group?
2. Have the purposes dynamic qualities?
3. Is the group faithful to the purposes?
4. Are the students involved in the group-work?
5. Are the special talents of non-involved used?
6. Are the activities arranged keyed to creative needs?
7. Is the group-discipline maintained by themselves?
8. Is the atmosphere of shared power and shared responsibility among the members of the group well maintained?
9. Is the group working with zeal and in a lively manner?
10. Has the approach really generated power of knowledge?

We may evaluate ourselves with the help of this criteria and have our interpretations on a Five-Point Scale. I feel sure that we will be achieving the desired results if we sincerely follow this approach.

The Teacher's Role

A good teacher starts with good questions, big and searching ones. He himself will be conscious and will help group members understand that no adequate discussion can take place until individuals feel confident and secure enough to make remarks freely in the group. He must try to encourage growth in the quality of fellow-feeling among the members of the group. He must lead the group to clarify the type of discussion. He should also help the group to determine its size and for this he should be able to use sociometric devices. He should refrain from monopolising the class time unduly by doing most of the talking himself if his pupils are to gain proficiency in active speech.[1]

Panchsheel of the Process

If this Group Dynamics approach is to keep up its dynamicism, each of the following Panchsheel must be its ingredient :—

1. Identification of need by members of the group.
2. Co-operative formulation of plans through which the identified need may be satisfied.
3. Involvement in action suggested by the plans.
4. Continual evaluation of planning and action.
5. Increased understanding of the significance of the process.

Thus Group Dynamics approach not only makes learning of a language meaningful and real but it enhances the quality of individual experience. India's great task is to develop people belonging to different castes, creeds, races and religions who can work and live together peacefully in a complex and inter-dependent society. The qualities of personality and the ways of organising, working and living according to the democratic way of life can be learned only when children grow in school circumstances that cherish, value and provide opportunities to practise.

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[1] I. Morris, **The Art of Teaching English as a Living Language.** (The English Language Book Society, Macmillan & Co., London, 1963, p. 17).

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7. Howard Lane and Mary Beauchamp, **Human Relations in Teaching. The Dynamics of Helping Children Grow,** (Prentice Hall, Inc., Englewood Cliffs, N.J.).
8. I. Morris, **The Art of Teaching English as a Living Language,** (The English Language Book Society and Macmillan & Co. Ltd., London, 1965).
9. Lucile Lindberg, **The Democratic Classroom—A Guide for Teachers,** (Bureau of Publications, Teachers College, Clumbia University, N.Y.).
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The Supervisory Role of Headmaster in Sainik Schools

S. N. Talwar

THE purpose of this paper is to describe the importance of supervision of teaching for the improvement of teaching imparted to the students in Sainik Schools. It is a well-known fact that all the civil organisations have employed supervisors for profitable running of the organisational machinery. Supervision is a necessity so far as these organisations are concerned. Observation, commonsense and experience shows that the real end of education can only be achieved when the teachers are helped and guided in their professional sphere. In this context, the supervision of teachers is of paramount importance in our schools where the "End of Education" or in other words, "The Aim of Training" is specifically defined, i.e., to train boys academically, psychologically and physically for various walks of life by ensuring a harmonious development of all their faculties.

Role of Public Schools

There are at present 49 recognised Public Schools in India. They are all members of the Indian Public Schools Conference and have to conform to certain minimum standards as laid down in their Constitution. These Schools are doing yeoman service to our Nation and are becoming increasingly popular among the masses because of their secular and 'All-India' character. They are the citadels of 'National Integration'; as students belonging to all social strata are admitted in the Military and Sainik Schools which are also members of the Indian Public Schools Conference. Over 80 per cent of students selected on merit enjoy scholarships in these schools. Besides, about 200 scholarships are offered by the Government of India every year to deserving students selected on merit for admission to Public Schools. Most of these schools have their own liberal schemes of granting scholarships to meritorious students.

In the gathering gloom of communalism and regional parochialism, Public Schools are holding fast the torch of unity and brotherhood. The use of English as a medium of instruction in most of these schools is based purely on practical considerations. There are, however, a number of schools admitted into ISPC which have Hindi as their medium of Instruction. Public Schools are free from Governmental pressure and are better equipped and staffed as compared with other schools. Their aim, to a large extent, is to explore and develop methods of quality education which can be repeated in general schools with profit. Since Sainik Schools are residential and there is a personal contact between the teacher and the taught, the teachers are solely responsible for moulding the character of their young pupils in their impressionable years. Hence the supervision of teachers in Public Schools has an added importance.

Supervision of Teachers

The discussion on the subject has been broadly divided under the following four heads:

I. Definition and Purpose of Supervision.

II. Types of Supervision.

III. Principles of Supervision.

IV. Methods of Supervision.

Definition and Purpose of Supervision

The word supervision can be defined in terms of techniques employed by various organisations or in terms of purposes for which it is used. The latter actually gives meaning to the techniques employed. In general, to supervise means to co-ordinate, stimulate and direct growth of teachers and in their turn stimulate and direct the growth of every student under their care through the right exercise of his talents towards most intelligent participation in the field which he has chosen with a view to making his career.

The Headmaster as a supervisor must have an ideal or an end which he wishes to accomplish—an ideal of the methods by which he must overcome in adjusting means to reach the end.

The main puposes of supervision in all schools and particularly in public schools are :—

(a) *To help the tenchers keep their attention focussed at all times on the real ends of training and the special role of the school in working towards these ends.* As a teacher is absorbed in helping students to learn a subject, he may not always maintain a clear distinction between ends and means. It is found that many a time teaching the subject seems to become an end in itself and students' mastery of the subject, the goal of all teaching. The Headmaster's first and foremost duty towards his teachers is to help keep their attention focussed on the main purpose of Education.

(b) *To help teachers see more clearly the problems and needs of students and to help them provide, as far as possible, for these needs.* No one can be taught effectively unless he is understood; no one is really receptive of teaching unless he believes that the teacher sympathizes with him in his ideals and ambitions and appreciates the difficulties he must overcome. The students can gain much from teachers by way of understanding, encouragement, information and sound advice. The Headmaster should constantly help teachers to keep in mind that the ultimate end is fostering the growth of the students into intelligent, effective, efficient and independent men.

(c) *To discover the work for which each teacher is most suited, to assign to him such work and to encourage him to develop further his capabilities in any promising direction.* Every person has some special talents and aptitudes, the development of which will make him of the greatest possible worth to the school and thus to the organisation to which he belongs. It is the prime duty of the Headmaster first to discover what talents a teacher possesses and then to make assignments accordingly.

(d) *To help teachers to develop further competence in teaching.* Proficiency in instructional duties is an art which is achieved through long and carefully directed practice. One is not "born" a good teacher. Our teaching staff are mostly selected for these duties because of their proficiency in their respective subjects. A teacher when helped to view his own performance honestly, becomes receptive to suggestions for improvement. Such suggestions may concern more effective methods of instruction; how to select appropriate training aid; organise material, choose audio-visual aids and plan directed study. But the Headmaster must be careful not to impose his own favoured ideas and practices with respect to syllabus or methods, rather he should work with the teacher in terms of latter's capabilities and the demand of teaching situation.

(e) *To advise and guide the newly appointed teachers.* Recalling one's own experience when entering a classroom for the first time in the role of a teacher will make one realise the importance of this purpose. In the beginning, a teacher is bound to be harrassed by the least important details of his work. He practises the art of teaching which he had experienced in the same classroom when he was a student himself. He becomes a slave to routine and may not appreciate his own strength. His capabilities as a teacher are dependent upon a leader, who guides, restrains, and encourages him during his first few months of his teaching career.

(f) *To ensure that the instructions are imparted in the most efficient manner by the teachers in accordance with the approved programmes and plans.* It is sometimes possible that a teacher may not agree with the importance given to a particular subject by the people who have drawn the plan keeping the goal of teaching in mind. In such cases the Headmaster has to ensure that the teacher is briefed properly, and convinced of the plans laid down.

(g) *To unify teachers into an effective team, working with intelligent and appreciative co-operation to achieve the common goal.* A unified staff is most essential for any good school. The problems like school management, student discipline and achievement of the common goal become less troublesome when teachers and the Headmaster have mutual understanding, liking, and respect. But this unity will not result from wishful thinking, it has to be worked for. Team work can be achieved only if the Headmaster keeps constantly before the teachers the common purpose for which they strive, if he guides each one to direct his work towards these purposes, if he makes it possible for each teacher to know and respect the contribution of others, if he promotes friendly relations and stimulates co-operation amongst all. One of the most disintegrating influences in our schools is the relative ignorance and consequent disrespect that some teachers have for the work of others in different fields of teaching. For a school to operate effectively, teachers must know and understand one another, recognise common goal and work towards it in harmonious and mutually beneficial ways.

II. Tyes of Supervision

Below are listed some of the proven and time-tested types of supervision :

(a) *Corrective supervision.* It is easy to find faults, but difficult to see them in true perspective. A fault discovered looks to be large out of all proportion to its importance and significance. The Headmaster going into a classroom with the intention of finding faults invariably meets with success. But without deprecating it unduly, the Headmaster should analyse it. Some faults can be overlooked as trivial, some can be noted down for later attention, some can be corrected by informal comments, while some may be so important as to need serious and constructive attention. Correction of any fault should be incidental and with a touch of humour. A major fault will need indirect approach and even the teacher should not be told about it.

(b) *Preventive Supervision.* With his own experience, and observations of instructions in the class, the Headmaster will come to know that certain difficulties will confront every new teacher. This may be due to the fact that the teacher does not know the principles of teaching and this can be prevented or overcome by developing in the teacher a thorough understanding and deep seated faith in these principles. Preventive supervision keeps a teacher from losing his self-confidence through failure to meet an unexpected situation successfully. It enables him to retain the respect of his pupils.

(c) *Constructive Supervision.* Supervision is not fault finding, neither it is merely the correction of faults. No fault should ever be mentioned until the Headmaster has a suggestion for its correction or a plan to propose that will lead to a remedy. In other words, supervision should always be constructive. Supervision should start with a vision of the goal and of the means to achieve it. The teacher and the Headmaster should keep their eyes fixed on the future rather than on the past. A wise Headmaster will attempt to share with teachers his vision of good teaching and he will stimulate, encourage and direct them to become competent to make it real.

(d) *Creative Supervision.* True creative supervision is rare. To be a creative supervisor, one needs to possess outstanding personal qualities, patience and tact, flexibility of mind, professional self-assurance balanced by intellectual humility and willingness to learn from others, understanding of people and faith in their capabilities, broad vision of educational purpose coupled with readiness to follow any of the several means adopted by others. The creative supervision means fostering creative activity and self-leadership within the staff, helping the teachers to become increasingly less dependent upon outside directions and more reliant upon their own resources of intelligence and enterprise.

III. Principles of Good Supervision

Under this heading some of the most important principles of supervision have been summarised :

(a) *Supervision should not be authoritarian based on personality.* A teacher who follows a suggestion or a direction merely because it is given by a superior official undermines his own personality and inhibits his own growth. He may comply because of respect or fear, he may find the suggestion immediately helpful, but he is likely to think less for himself, to grapple with his own problems, to seek to find the reasons why he should teach this or that way. He is more likely, when another difficulty arises, to run to the Headmaster for specific help either because he has received it before and is helplessly eager to receive it again, or because he fears to act independently without official direction. In other words, the teacher becomes most likely to switch allegiance, to follow blindly any suggestion made by authorities whether or not it is sound or appropriate to the situation.

(b) *Supervision should never be divorced from a constant recognition of the goals of teaching.* This principle is fundamental, whether it is classroom observation, teachers' meetings or supervisory conferences. The Headmaster should have constantly in mind the goal of teaching and specific contribution to that end that every group of experiences can make.

(c) *Supervision should not, as a rule, be largely concerned with the details of subject matter or of teaching.* Details of subject matter have meaning only in reference to the whole of which they are parts. An assignment, a question, or a test may be good in one situation and entirely meaningless in another. When details are emphasized, it usually destroys perspective.

(d) *Supervision should never be nagging.* The best results from supervision are obtained by encouraging and directing the growth of power already possessed by teachers. A Headmaster has to come across the deficiencies of a teacher and suggest remedial measures. He will have to be frank and straight-forward, using such tact as the teacher's personality and emotional state demand. He should have an impression that the criticism is merely a beginning of a co-operative effort to make the teaching better.

These principles of supervision have been stated negatively just to warn the Headmaster as to what he should not do. Now here are some characteristics of good supervision positively stated :

(i) *Supervision should be constructive and creative.* Although supervision must at times deal with correction of faults in teaching, its highest achievement is to liberate the constructive intelligence and imagination and creative power of teachers to the end that the goals of teaching at the school may be reached.

(ii) *Supervision should be democratic.* The Headmaster should recognise the actual or potential value of a teacher and proceed on the basis of such recognition. Supervision should not be based on authority but on the basis of collective thinking and group decisions. In a democratic setting, a Headmaster operates as a leader and a guide rather than an authoritarian.

(iii) *Supervision should be based upon professional rather than personal relations.* A teacher's first loyalty is not to his Headmaster, nor even to the school, it is to the student under his care. Moreover, like the Headmaster, the teacher is also a professional worker, possessing the right to make independent judgment of training matters. The Headmaster and the teacher should respect each other's professional status and strike to achieve accord through common acceptance of approved principles rather than by appeals to personal loyalty. In his dealing with teachers, the Headmaster should be friendly and informal but not paternal and never condescending.

(iv) *Supervision should seek to promote the growth of teachers by developing their special strengths.* Every individual is the sum of numerous virtues and of some defects; human work is judged by the quality and intensity of the virtues rather than by the paucity of defects. The Headmaster should appreciate the good points of the teachers rather than look for their weaknesses. The teacher, who is conscious that his Headmaster not only recognises his merit, his ability and promise but is also discriminatingly competent to do so, is happy at his work, eager to demonstrate his best, receptive to suggestions and ever ambitious to exert himself to achieve the goal.

(v) *Supervision should be gradual, progressive and persistent.* In the beginning, supervision should attempt some simple and constructive help with consideration of the attitude of teachers. In the first few weeks, no adverse criticism should be made rather efforts should be made to focus the teacher's attention on improving his methods of instruction defects. This leads to better understanding and the teacher becomes receptive to suggestions. The Headmaster must be patient, sympathetic and persevering in faithfully carrying out the programme that he has made for himself,

(vi) *Supervision should be adapted to the capacities attitude and even prejudices of the teachers.* The Headmaster must have the full knowledge of his teachers, some of them may be having great competence and abundant capacities, others may be limited in both respects. It is human tendency to underrate abilities and to exaggerate limitations. But the Headmaster has to make constant effort to estimate each justly. This means, of course, that some part of supervision must be highly individual in order to allot the job to an individual teacher as per his liking, attitude and capacities.

(vii) *Supervision should be characterisd by simplicity and informality.* The Headmaster and the teachers have a common responsibility which they can best understand when they have described it in simple language. Not only should supervision be simple in its conception and in its expression; it should for the most part be informal too.

IV. Methods of Supervision

We have discussed the objects and principles of supervision and shall now consider the methods for achieving those objectives.

Help teachers to realise the Aims of Education. It has been mentioned earlier that in order to teach well a teacher must possess a sound philosophy of education and must clearly formulate, accept and consistently seek general objectives in accordance with this philosophy. Good teaching is not only possessing the right professional motivation, goodwill towards pupils and mastery of some important techniques of the craft; basically at all times teachers must know and consistently keep in mind why they are teaching and what goals they hope to attain. This is achieved by :

(a) Teachers' meetings and suggested readings, where the Headmaster should convince the teachers of the soundness of ensuring effective and economical instruction.

(b) The Headmaster should make special efforts to clarify the minds of the teachers as to the difference between ends and means.

(c) The teachers be encouraged to organise themselves in smaller groups to work out effective procedures for specific principles in their methods of instruction.

(d) The Headmaster should encourage teachers to review the lessons that they have recently taught and the plans that they have made for the immediate future.

Classroom Observation. Basically the improvement of training is effected through instruction and the promotion of it is the principal aim of supervision. The Headmaster who is actually concerned with the improvement of instruction must enter the classroom and observe the instruction being given and the learning which takes place. This is the only method by which a Headmaster will get first hand information about the training programme in order to assess its correctness or otherwise. It is not only the Headmaster who can visit a classroom but even the teachers be encouraged to visit the classrooms of other colleagues to observe the instruction. Teachers learn as much from their colleagues as they do from the Headmaster, perhaps more. Improvement of instruction is the immediate responsibility of the Headmaster and his obligation regularly and systematically to observe teachers at work must be counted among his most sacred duties.

Classroom Visits. In order to get maximum benefit out of classroom visits, the Headmaster is advised to always bear the following in mind :—

(a) Before entering a classroom, the Headmaster should be quite clear in his mind of the purpose of his visit and the object that he is to achieve. It is no use just 'dropping in' in any classroom without preparation. Some of the purposes of the classroom observation are:

(i) To learn the instructional practices of each teacher and to evaluate them with reference not only to basic principles but also to the practices of other teachers.

(ii) To discover the good and promising characteristics of each teacher.

(iii) To discover the needs of teachers.

(iv) To stimulate teachers to do their best.

(v) To obtain information for use in planning and guiding the supervisory programme.

(vi) To discover the extent to which teachers are endeavouring to apply supervisory suggestions previously made.

(vii) To get material that will determine what the supervisory programme should be.

(viii) To develop confidence in the supervisory programme because the teachers realize that the Head of the school knows what they are doing.

(ix) To learn what administrative changes will facilitate good instruction.

(b) On entering the classroom, the Headmaster should as quickly as possible acquaint himself with what is going on in the class. This can be done by listening to the teacher and the students.

(c) If the Headmaster enters the classroom after the class has begun, he should not disturb the work.

(d) The Headmaster should stay for enough time, say half an hour or so in the classroom to see things for himself before coming to any decision.

(e) Although no exhaustive list can be prepared for the points to be observed by the Headmaster during his visit to a classroom, the following few things must be looked into by him:

(i) Preparation of lesson by the teacher.

(ii) Method of instruction and the way it is put across to the students.

(iii) Use of lesson plans by the teacher.

(iv) Use of teaching aids.

(v) To what extent the students have followed the lesson.

(vi) General standard of the classroom discipline maintained by the teacher.

(vii) Whether teaching techniques are followed correctly.

(f) The Headmaster should never for one instant forget that in the classroom the teacher is the host and he is the guest. He should always maintain this position so that the teacher retains his self-respect.

(g) Keep a detailed record of classroom observations (See Annexture).

(h) Any observation made by the Headmaster should be brought to the notice of the teacher immediately after the period is over. The Headmaster should never interrupt the class to give to the teacher remedial help.

(j) The faults of the teachers should not be pointed out to them in the presence of their students.

(k) If any instructions were given to the teacher, the Headmaster should again visit his class to find out whether the teacher had understood him or not and whether he was showing the desired improvement.

(l) If the Headmaster finds some thing good during his visit to a classroom, he should point out to others what has been observed that merits sincere and discriminating commendation. This will encourage the teachers and the students.

(m) If the Headmaster wants to put a question to the students to find out how much they have grasped he may seek the permission of the teacher.

(n) It is seldom wise for the Headmaster to take over the class for a demonstration of good teaching or for any other purpose. Any demonstrative teaching by the Headmaster should be usually arranged before hand and preferably consume the entire class period.

(o) If the Headmaster has to leave the classroom before the period is over, he may slip out quietly without disturbing the teacher or distracting the attention of the students.

(p) The worst type of observational visit is casual, unplanned, purposeless, and without results. The better kind will always be planned as a part of the comprehensive supervisory programme and will seek one or more of such purposes as stated earlier. The supervisory visits should be primarily concerned with the preparation for the improvement of instruction and teaching aids.

(q) The Headmaster should always ensure that the teachers are evenly loaded.

(r) The Headmaster should review the position of the textbooks and stationery and ensure that enough copies of these are in stock for distribution to the students.

Characteristics of a Headmaster

Before we come to the end of this discussion, here are some of the characteristics of an ideal Headmaster :

(a) He must know the subject-matter and have an up-to-date knowledge of teaching methods and use of modern teaching aids.

(b) He must have had experience as a teacher since he must be able to judge not only *What* the teacher is teaching but *How* he is teaching.

(c) He must have knowledge of administration. He must remember that he is there to help the staff to do their job efficiently.

(d) He must see that all teachers have time to prepare their work, a suitable place in which to do it and that they prepare a lesson plan from which to work.

(e) He must be a leader. He must be able to direct the staff under his supervision with tact and firmness.

ANNEXURE

Suggested Record Form for Assessment of Teachers

Name of teacher____________________ Subject taught____________________

Class____________________ Duration of the class____________________

	Five-Point Evaluation Scale					
Did the Teacher	*4*	*3*	*2*	*1*	*0*	*Remarks*
Object 1. Make the object clear ? 2. Maintain the object without digressing ?						=10
Preparation 3. Know his stuff ? 4. Plan his lesson well in a sequence and summaries written ? 5. Prepare good training aids ?						=10
Technique 6. Have a good manner, bearing enthusiasm, voice, delivery gestures and Mannerism ? 7. Have an attitude suitable for the subject and the class—fair, firm and friendly ? 8. Use a form and technique suitable to the subject matter and class ? 9. Use his training aids well ?						=10
Did the Class						
Regurgitation 10. Show interest and keenness throughout the lesson ? 11. As far as possible, participate in the lesson ?						=10
Assimilation 12. Check assimilation ? 13. Time lesson well ?						=10
						=50

Other relevant points noted during the lesson and the remedial measures suggested.

____

Signature of Headmaster

Date____________________

A School Complex in Action

K. R. Udupa

The Problem

It was the second week of June, 1965. The admissions for the first year class of our Higher Secondary School were just over. The classes had just started working. A couple of days later, the teacher entrusted with the teaching of English to Standard VIII, the first year class, came to me, apparently quite uneasy and worried. He was one of the best teachers of English. When asked, he revealed to me his utter disappointment at the standard of attainment in English of the newly admitted pupils. He complained that it would not be possible for him to make the class, as a whole, to go through the prescribed syllabus for the year. He had concrete illustrations to give. He had administered a spelling and comprehension test to the class on the first day. Out of 145, not more than 15 pupils had scored pass-marks. The standard of the test administered was not high for that class; but the result was extremely discouraging. Many pupils were not able to distinguish between "see", "she" and "sea"! The common words like 'walk' were spelt as "wok". In the opinion of the teacher, pupils were equally backward in pronunciation and oral expression.

The teachers handling other subjects in the same class were also consulted. As a result of the discussion, it was decided to tackle this problem on a more scientific basis. In order to find out the areas of deficiency and sort out the backward pupils, we decided to administer diagnostic tests to the class, in all the subjects.

The students to the first year class of our School were drawn from fifteen Higher Elementary (or Upper Primary) schools. These feeder schools were situated within a radius of two miles from our School. These pupils had appeared for a district level common examination at the end of Standard VII, and possessed Pass Certificates. In spite of this, we found them to be quite unsuitable for the class to which they were admitted.

Diagnosis

After the diagnostic tests were adminisιered, the pupils were sorted out and grouped on the basis of the feeder Schools from which they had passed out. The results were analysed school-wise and subject-wise. It made a very interesting study. There were varying degrees and levels of attainment among the groups of pupils, from school to school and subject to subject. Only five percent of the pupils coming from School "A" had scored pass marks in English, while 60 per cent of the pupils of the same school had secured first class marks in Mathematics. It was evident that in this particular school, English was very much neglected in Standard VII, while thorough grounding had been given in Mathematics. In School "B", General Science was very much neglected. In Schools "G" and "K" Social Studies had not received enough attention. Thus, with the help of this result sheet, analysed school-wise and subject-wise, it was possible to locate the area of backwardness among pupils who had come from a particular school.

The result of the tests brought to the forefront the following two important problems, which the teachers of the first year class had to tackle.

The problem of general backwardness

The teachers felt that they would not be able to introduce the prescribed syllabus to that particular class, before giving them thorough grounding in the portions already covered in the primary classes by means of bridge courses.

The Problem of Different Levels of Attainments

The class as a whole was a heterogeneous group, consisting of students having various levels of attainments. The pupils in each of the four sections were classified into groups in respect of each of the subjects according to their attainments, as (i) poor, (ii) below average, (iii) average, (iv) above average and (v) gifted. The teachers felt that no useful purpose would be served by teaching the pupils, taking the class as a unit.

Tackling the problem

Having spotted the problem, we decided to tackle it at two different stages:

(1) *At the Primary Feeder School Stage*

(2) at the High School Stage.

(1) *At the Primary Feeder School Stage*

This meant correction of the maladies on a long term basis. The aim was to enable the primary schools to improve their standards of instruction in general, and send better equipped end-products to our High School in future years. But this was by no means an easy task. We had to work with situations out of our direct control. We had to go to the fifteen Primary Feeder Schools, work with them, and eventually win their confidence and co-operation. But we were convinced that seeds of sound secondary education should be sown in primary schools, and unless the standard of instruction at the primary school improved, it would not be possible to achieve higher performance at the High School stage.

In order to achieve the desired result at the Primary Feeder School Stage, the following techniques and procedures were adopted:

(a) Soon after the diagnostic tests were administered and the results analysed, each one of the feeder schools was supplied with a copy of the result-sheet. This sheet gave a comparative study of the attainments of different schools in different subjects. The Heads of these Feeder Schools got an opportunity to compare:

(i) the total performance of his school with that of other schools in the locality;

(ii) the performance in individual

subjects with those of other schools; and

(iii) the efforts put in and work turned out by different subject teachers in their own schools.

That some serious thinking was initiated about this result-sheet was quite evident. Within a week, half a dozen Headmasters of the Primary Schools came to explain to us why their school had done badly in some subjects that particular year. It was quite clear that their pride had been hurt. Some assured that they would give a better account of themselves next year, if the experiment was repeated. But the purpose had been served. The comparative result-sheet aroused a feeling of awareness and competitive spirit.

(b) This being done, we invited the Heads of these schools to meet us on an appointed day. We explained to them the purpose of this project. They were made to understand that it was not our intention to hurt anybody's feelings by exposing their deficiencies, but only to help them in improving instruction in schools. We extended to them our hand of friendship and co-operation in improving the standards of their schools. We chalked out a programme, by which we could assist the feeder schools and placed it before the Heads of the feeder schools, so that they could explain the same to their respective staff members and make them agree to participate in the programme.

(c) But this was not easy. Generally teachers have a habit to shun whatever new is placed before them. Some had a feeling that it was an unwanted interference in their daily work. So some sort of compulsion was also necessary. Luckily for us, out of the fifteen schools, eleven were managed by private agencies. The Managers of these schools were approached and they were requested to bring some sort of compulsion and pressure to bear on the unwilling teachers of their schools. The Departmental Officers of the School-Range were also requested to use their influence to encourage the teachers to participate in the programme.

(d) In order to arouse the competitive spirit among the feeder schools, it was decided to present a running shield to the Primary School, which produced the best result in the District Level Common Examination at the end of the Primary Stage. The competition was open only to the fifteen feeder schools. The shield was to be presented at the next Annual Day Celebration of our School.

(e) It was necessary to remove the inferiority complex prevailing among the teachers of the primary schools. They had to be given some encouragement to mix freely with the high school teachers and feel proud of their role as educators. The following methods were adopted to achieve this:

(i) Teachers of the Primary feeder schools were requested to act as judges for various competitions held during the School-day Celebrations of our School.

(ii) Competitions were organised for the teachers and students of the primary schools and prizes were given on the occasion of our School-day.

(iii) Children's Day on 14th November and Teachers' Day on 5th September were organised as joint functions of all these schools, making our High School as the centre of all the activities.

(iv) The students and teachers of the Primary Schools were invited at least once in a month, by turn, to the film shows organised by our Audio-Visual Education Section.

These measures helped to a very great extent in removing the feeling of isolation on the part of the Primary School Teachers.

(f) Making use of the monthly Teachers' Association Centre meetings, where all the Primary School teachers assemble, a series of talks on modern techniques and methods of education were given. Demonstration lessons on different subjects by competent teachers were arranged. Improvised apparatus, charts, maps, models, etc., prepared by the students and teachers for our School exhibition were demonstrated and then given as gifts to the feeder primary schools. This went on month after month for a whole year, based on a regular systematically drawn up programme.

All these measures enabled the teachers both of the primary schools and our High School to recognise the fact that education is a continuous process. The old idea of seclusion and compartmentalisation of the stages of education was successfully removed. The teachers were able to come out of the old rut.

The same process was continued successively for the next two years. The result sheet drawn after the Pre-Test in June, 1968 revealed a definite improvement in the situation. In School "A", more than 45 per cent had scored pass marks in the pre-test, which had the same difficulty level as in June, 1965. The standard of attainment of the class in different subjects was almost the same. In June, 1968, the class as a whole presented a more homogeneous group than it did in 1965. This showed that the project had yielded the desired result.

(2) *At the High School Stage*

The problem of backwardness and varied levels of attainment in the same class at the beginning of June, 1965, had to be tackled by ourselves in our own School. Before the teachers could carry on with their usual course, as laid down in the syllabus for Standard VIII, some degree of uniformity had to be achieved, and the general standard of the class had to be improved. In order to achieve this, the weaker sections had to be pulled up. They had to be given a thorough grounding in the fundamentals in each subject. We decided to spend the first 2 months and a half, up to the end of August, in giving the pupils a bridge-course in each of the five subjects. We had already classified the pupils into five groups. Then, assignments in the form of questions and test items were prepared. They were prepared to suit the standards of the lowest three groups of the class. The pupils were given the assignments in advance, they were helped to work them out and then were asked to answer them. The brighter pupils of the immediate higher group were made to render assistance to their weaker brethren of the lower groups in working the assignments. By the end of August, a set of ten assignments was given and worked out. In the first week of September, another common test in each subject for the whole class was administered and the results were analysed. The result was really encouraging. The glaring disparities were removed. The gap between group (a) and group (e) was very much narrowed down. This enabled the respective subject teacher to go on with his lessons with greater confidence.

Conclusion

Our High School has benefitted much by this experiment. It is my earnest belief that any high school, faced with the problem of teaching a large class, comprising of pupils drawn from various primary schools, with varied standards of attainment in different subjects, has only to undertake a project like the one we undertook. Now-a-days, it has become almost a fashion for the colleges to put the blame for backwardness of students and lowering of standards on the high Schools, for high Schools on the primary Schools, and so on. But this will not help much. In the changed circumstances, in the midst of the terrible explosion that has already taken place in the field of education, we, the educators who are working at different levels—from the Nursery to the University—have to play our own part, willingly and effectively, to arrest this tendency. In this respect, this experiment is useful and worth attempting.

Needless to say, there were difficulties in implementing this scheme carrying it on to a successful conclusion. First of all, there was the problem of getting the teachers of primary schools involved in this programme. Fairly a large percentage of them had fallen in a rut. A good many Headmasters, who had worked out the projects of "School complexes" in the course of their confidential talks, make us understand that the teachers were not co-operative to the desired extent. But this is not an insurmountable difficulty. The various devices adopted by our school, as already explained, helped to enthuse the teachers and instil in them a sense of duty and awareness of their responsibilities. We ought only to be careful in our approach. We have to go to them as friends but not masters. Some sort of pressure, through the Managements and the Department of Education, also will be helpful, but it has to be exercised with great care.

Secondly, some amount of resistance is always to be expected from the staff members of the high School that takes up this project. There might be grumblings about extra work for the teachers, involved in the experiment because their load of work which is already heavy has increased. The availability of extra time for those teachers to prepare and administer the tests and assignments is also a factor to be considered. But, it is the initiative, zeal and enthusiasm and love of the head of the institution that should enable the other teachers to evince interest in the inculcate love for this project. The Head of the School can also come out of the set pattern of the routine time-table and the minimum work-load in respect of the teachers and the class for that period of the School year, when this project is worked out. More than anything else, if the teachers are made to realise that this extra labour in the beginning of the year will make his work easier and enjoyable for the rest of the year, there is no reason why they should hesitate to participate in a worthwhile project like this.

Construction of Diagnostic Tests in Mathematics for Standard VIII and Use of Remedial Measures

A. R. Modi

Introduction

FROM the teaching experience of about fourteen years in mathematics, as the teacher, I have always felt that **something must be done for the pupils who are weak or slow learners in mathematics**, in higher standards of his School. I came to know something about the **Diagnostic Tests** from the lectures given by well-known mathematicians, **at the workshop held by Directorate of Extension Programmes for Secondary Education, at Allahabad, in January, 1966.** This inspired me to construct and try out diagnostic tests in mathematics. As mathematics starts in Standard VIII, **I preferred to take the above-mentioned project in one of the sections of Standard VIII.** So I started the project in Class C of Standard VIII.

I thought that the construction and use of **the diagnostic tests would serve the purpose of locating the difficult areas of mathematics** for the pupils, but that was not enough. I got **the idea of using necessary** remedial measures after •diagnosis from the book, **Diagnostic and Remedial Teaching in Elementary and Secondary Schools.**

By taking this project, I became more interested and began to collect the books written on Diagnostic Tests on Mathematics and Remedial Measures.

I began to prepare the Diagnostic Tests on Algebra, Geometry and Arithmetic one after another. The administration of the Diagnostic Tests and the response of the students made me construct more such tests throughout the year on the topics and subtopics taught in the class.

Specific Aims

The following were the **specific aims** to be achieved by the project :

(1) **To divide the course into 8 topic and to make the students learn them properly, i.e., to enable the pupils to understand properly the concepts, facts, and principles of Mathematics by drawing their attention towards their wrong concepts**

and misunderstanding of facts and principles.

(2) **To apply diagnostic procedures.**

(3) **To take remedial measures.**

The other aims were :

(1) **To enable the students to understand the problem thoroughly** by drawing their attention towards lack of thorough study of the problem or omission of essential ideas, facts and figures.

(2) **To enable them to develop their computational skill** by locating the areas of their difficulties and giving proper guidance and drill work in these areas.

(3) **To enable them to apply their knowledge to unknown situations** in every day life by giving problems of every day life and helping them whenever necessary.

(4) **To enable them to develop logical thinking inductively and deductively** by drawing their attention towards their **wrong concepts** of logical thinking and understanding.

(5) **To fill the gap between the clever pupil and dull or slow learning pupil** by constructing necessary diagnostic tests and using remedial measures for the dull or weak pupils.

(6) **To create interest in mathematics by using recreative mathematics, audio-visual aids, excursions, debates, talks and lectures by experts in mathematics.**

Other General Objectives

This project has the following general and long-range objectives also :—

(1) **The pupils may form the habit of putting questions and getting proper answers to get a thorough knowledge of the topic**

(2) The students may form **the habit of using textbooks writtten by other authors** on the same subject.

(3) The students may form the habit of using and reading **the books of the school library.**

Limitations

The following are the **limitations experienced by me** during the year :

(1) **In this project I have used the Diagnostic Tests made by me.** They are not standardized. I have made those tests in the light of American books on that subject.

(2) **The class was not selected formerly,** so there was great variation in the intelligence and interests of the pupils.

(3) More than 50 per cent of the girls had failed in Mathematics in Standard VII.

(4) **The class consisted of 59 girls. This number** was very **big resulting in increased** work-load **for the teacher,** administration of the tests, assessment of the answer-books in time, finding and recording of errors of each pupil in her file was rather difficult.

(5) The diagnostic tests were to be cyclo styled by me but I had no free time for that.

(6) I was often sent to the class of an absent teacher.

(7) I had to examine the English Composition notes and other science journals of different classes.

(8) Some of these things had to be done at home during my leisure time.

(9) I had to finish the syllabus and monthwise course in time and no special facility was given.

(10) **The terminal and annual examinations**

took place side by side. The pupils had to appear in these examinations administered on two or three topics together.

Definition

Weak and Slow Learners

Those pupils who scored low at the examination and had low Intelligent Quotient were considered as weak students. Those pupils who scored low at the examination but had a normal Intelligent Quotient and required drill work were considered as slow learners. About 28 weak and slow learners were selected for remedial work.

Preparation and Procedure

Preparation

I invited other teachers interested in mathematics. **The supposed wrong concepts** of the pupils in Standards VII and VIII were discussed. A list was prepared, and in the class special attention was given to those wrong concepts and the teacher tried to eliminate them. **The other wrong concepts that arose in the class were dealt with instantly.** In the diagnostic tests, **stress was laid on finding out the wrong concepts existing in the mind of pupils in Arithmetic, Geometry and Algebra.**

Procedure

I started teaching Standard VIII Class C as usual. The class consisted of 59 girl-students. To know their level of intelligence, Intelligent Quotient tests, made by Dr. K. G. Desai, the Principal, A. G. Teachers' College, were administered. From their results, lists of the normal students and slow learners were prepared. Special attention was given to these students throughout the year. After finishing one or two topics in each subject, a diagnostic test was administered to the class. The errors as well as the achievement results were recorded in the file kept by each pupil separately. **To eliminate the errors, underlying facts and principles were explained in the "Project-Period",** and other difficulties were also solved during that period.

To create interest in mathematics Audio-visual aids were utilised. Talks by other mathematics teachers were organised, debates were held among the students who were also encouraged to make charts and models explaining facts, concepts and principles of Geometry, Algebra and Arithmetic.

The assignment of home work was checked by the monitors who were good at Mathematics. The home-work note-book of each student was examined by the teacher occasionally and errors in the examples or calculations were noted down and were explained to the students individually.

Research Tools

As I got experience in teaching the students, I acquired new insight. With such a big and heavy class, I used the technique of "Programmed Learning" which had a magic effect on the pupils and proved very successful in remedying the weaknesses of students. Miss Mrugavati Sarabhai Shah, Reader, State Institute of Education, was highly interested in my project work; she used my frames of Programmed Learning in other schools with great success.

Activities, Tools, and Technique used in the Project

Before I started my work of the project in Class "C" of Standard VIII, I looked at their results of mathematics in Standard VII. Out of 59 pupils 29 had passed, and 30 pupils had failed. I also tested the same class in mathematics in the course of Standard VII. **I found the following defects :—**

(1) The pupils did not know how to measure angles and where to put the protractor while measuring and angle.

(2) They did not know the use of other Geometrical instruments.

(3) They were drawing shabby figures.

Wrong concepts in Arithmetic:—

(1) They did not understand the word "Interest", "Compound Interest", etc.

(2) They did not understand the meaning of "Ratio", "Proportion".

After class teaching, I thought that I must give diagnotic tests. In Geometry I had to impart knowledge of the use of different apparatuses and the properties of various figures, and develop the skill of drawing figures. So I decided to take up Geometry teaching in three stages :—

I. *Practical Stage*

II. *Intuition Stage*

III. *Logical Stage (Theory Stage)*

I could not omit the intuitional stage, because it is the link between the practical stage and the logical stage. That means there is no water-tight compartment; it is all inter-woven. In this intuitional stage, pupils by seeing figures can atonce say that "vertically opposite angles are equal", or "in isoceles triangles two angles opposite to equal sides are always equal."

Moreover I wished to develop the power of imagination and of logical thinking. He had also noticed the pupils lacked in accuracy, and speed and were weak in the use of apparatus.

Knowing all these I wished to prepare diagnostic tests to measure their ability, to find out their errors, and to find out ways to remove their weaknesses.

After knowing the errors committed by individual students, I gave graded exercises to be done by the same student. I tested them again and again.

Diagnostic Processes

I used Diagnostic Processes as follows :

I. To find out which particular student experiences difficulties.

II. To find out the area where the students committed mistakes.

III. To find out why a student commits mistakes.

IV. To decide upon suitable remedies.

V. To find out how the repetition of the same mistake can be avoided by the student.

To find out which particular student experiences difficulties

I used different ways and methods to find out which particular student experienced difficulties. I found out the weakness with regard to the knowledge of students. I gave various tests by which I could find out how much knowledge they have acquired.

The results of the I. Q. tests were interesting. The students who had failed in mathematics were better in I.Q. tests. So I had confidence in improving such students. I divided the whole class into three groups :

I. Scholastic group who were good at study.

II. Mediocre students who were of average level at study, and

III. Weak students who were rather slow learners.

From these three groups again I had to form study-circle of students so that they could help each other in their study and could come out with what they did not know without any fear.

I had to keep a separate note and a file of each student, to note down their mistakes in finding direction, in measuring angles, addition, subtraction, decimal points, etc. These mistakes were helpful to me in preparing further frames of diagnostic tests.

Finding out the area where the student commits a mistake.

In order to find out the exact type of difficulty, I used diagnostic tests. In preparing the diagnostic tests I made use of the following types of **objective tests:**

(1) *True-False Type Tests*
(2) *Matching Tests*
(3) *Multiple Choice Tests*
(4) *Association exercises*
(5) *Filling in of gaps*

Finding out why a student commits mistakes

I thought that it is more important to find out why a student commits mistakes **than to find out where he does so.**

From the results of the diagnostic tests I could only measure the **results** but **not the reasons.** So I had to know the history of a particular student. I called their guardians as stated before. I got little success. The negative results worried me most. I inquired indirectly and new that the **house-hold work, bad habits, lack of interest, improper** atmosphere of the house, school, cinemas, newspapers, radios, etc. played an important role in preventing the students from improving their knowledge. I also knew that there was not a single defect in the individual student but lack of carefulness was one of reasons.

The suggested Remedies:

I noted down the difficulties and mistakes of individual students, and **gave them individually graded exercises prepared by** me. When other students also demanded the same graded exercises, they had to be given to them.

After finishing the topic, I administered diagnostic tests to the whole group and the result of the whole class was recorded. **The record of each individual student was kept in separate files.**

Finding out how the repetition of mistakes can be avoided:

In the class there are different types of students. They have different interests, different likings, and different tendencies. Their intellectual ability also differs. So I tried my best to create interest in the subject of mathematics.

(1) **by telling the history and work of great** mathematicians like Pythagoras, Ramanujan, Lilavati, etc.

(2) by showing mathematics films on decimal numbers, on additions and subtractions. The films (1) "Mathematics at your Finger Tips", (2) "What are decimals ?", (3) "Decimals are easy", and (4) "Metric System" were also exhibited during the teaching hours and in the periods of the absent teachers.

(3) **By getting the confidence of guardian** which helped me to proceed further.

The Method of Programmed-Learning

This method was invested by Prof. Skinner, a Psychologist. a Professor of Harvard University of America. The basic principles of this method are as follows:

(1) **Small steps,** leading to higher steps, with prompting.

(2) **Activity of the Learner,** learning by doing.

(3) **Immediate** knowledge of the result—a stimulus.

(4) **Progress,** based on individual capacity.

(5) **Evaluation,** by test-frames.

Programmed Learning technique came

to his help. In this technique the whole subject or the topic is divided into sub-topics. The graded frames are made in such a way that a student reads each frame one by one, understands them and gives answers to the questions given at the end of each frame. If his answer is correct, he gets prompting and proceeds further. The answers are hidden just below each frame or on the left hand side of the next frame. **If his answer is wrong, he is asked to refer to certain previous frames, to understand them properly and then try the same frame again.** This method helps the student in becoming self-dependent, and the teacher has to give little guidance or explanation. So I also made frames of "Programmed Learning" on "Percentage". They were cyclostyled and given to each student to study during the mathematics periods. Then I made diagnostic tests on "Percentage" and tested the students, result showed that the learning of the weak and slow learning students had improved. **I also framed self-study graded exercises in other topics of Arithmetic Algebra and Geometry.** He tested the students individually and the class as a whole every now and then. The analytical table showed very good progress.

Step by Step Implementation of the Project:

While preparing diagnostic tests, I took into consideration the followng important points :—

I selected the tests in such a way that all the graded exercises were included, beginning with easy exercises they were made harder step by step.

Analysis of the Errors Committed by the Students:

After scrutinizing the results of 8 diagnostic tests, he found various important errors committed by the students in mathematics. **I cannot give here the whole lists of the errors, but some leading errors and their frequency are given below.**

Analysis of the Errors, found in Algebra and their Frequency

Diagnostic Test in Algebra

Topics : (1) Formulae
(2) Addition of simple algebraic numbers
(3) Brackets

	Errors	*Frequencies*
(1)	Error in the process of multiplying the algebraic numbers	20
(2)	Error in changing signs in subtraction	26
(3)	Subtracting instead of dividing	10
(4)	Failing to comprehend which process is to be used	18
(5)	Failing to add numbers in the algebraic manner	22
(6)	Failing to remove brackets in the required order, and committing mistakes of signs	35
(7)	Examples on brackets	13

Analysis of the Errors Found in Geometry

Diagnostic Test in Geometry

Topics : (1) Angles
(2) Directions
(3) Drawing maps showing the path of travelling

	Errors	*Frequencies*
(1)	Students named the wrong type of angle, from the given data	21
(2)	Students divided the obtuse angle in a wrong way	15
(3)	Students calculated wrongly the required complementary angle from the given data	35
(4)	Students gave a wrong measure of the angle between two given directions on Mariner's Compass	31
(5)	Students could not draw the path of travelling using correct angles, sides and direction	41

Analysis of Errors Found in Arithmetic

Diagnostic Test in Arithmetic

Topics : (1) Decimal Fractions
(2) Approximate Numbers

Errors	*Frequencies*
(1) Students expressed the given decimal numbers wrongly, and did not count their digital positions	22
(2) They moved the decimal points to the right while dividing the given decimal numbers by 10, 100, 1,000, etc	25
(3) They did not put the decimal points just below each other in adding decimal numbers	18
(4) They failed to express the given number approximately up to 10,000	3
(5) They committed computational mistakes in converting a fractional number into the decimal number	44

Only finding errors by the diagnostic test is not enough to improve the learning of the weak and slow learning students.

In the following table he gives a few causes of errors in Algebra, Geometry and Arithmetic, and what remedial measures were used for them.

Causes of Errors in Algebra and Remedial Measures

Causes	*Remedial Measures used*
(1) The students could not understand the significance of algebric letters such as x, y, a, b, etc., so failed to make simple formulae.	(1) It was again explained that 1, 5, 10, 15 are all numbers having fixed value, while letters x, y, a, b, etc., have unlimited value.
(2) They did not know the relation between interest, sum and period and percentage of interest.	(2) The following formula with various sums was explained and drill work was done. $\text{Interest} = \dfrac{\text{Sum} \times \text{Percent} \times \text{Period}}{100}$
(3) Lack of understanding the powers of a number and the multiplication and addition by the same number.	(3) The difference between x^3 and $3x$ was explained. $x^3 = x \, . \, x \, . \, x$ (multiplication). $3\,x = x + x + x$ (addition).
(4) Lack of comprehension of the process required in removing different brackets in a proper order.	(4) The order of removing the brackets was again given. A large number of sums on brackets were given for practice, from other text books.
(5) Lack of comprehension of the process required in solving simple equations and fractional equations.	(5) The methods of taking L.C.M. multiplying each side by L.C.M., without writing the L.C.M. in denominator, and transportation with due care to the change of signs were explained. More sums of similar types were solved with the help of students on the board, and enough examples were given for drill work at home. **The booklet "Programmed Learning in Algebra" was given to each student.**

Causes of Errors in Geometry and Remedial Measures

Causes	*Remedial Measures*
(1) Lack of knowledge of the definitions of a complementary angle and a supplementary angle.	(1) Figures for complementary angles were drawn on the blackboard. Complementary angle=90°–Given angle. This formula was illustrated with various examples. In the same way supplementary angles were explained.
(2) Lack of knowledge that the directions are always shown in relation to either the North or the South.	(2) Various directions were drawn on the blackboard and students were asked to scrutinise the true directions showing proper reasons.
(3) Lack of knowledge of rules for finding the interior angles, exterior angles and the sides of the given polygon.	(3) The rules were illustrated with various examples from other text books of Mathematics. **Charts and Models were made by the students illustrating the above rules.**
(4) Lack of skill in drawing quadrilaterals, parallelograms, rectangles and squares with the given data.	(4) The use of mathematical instruments was explained. The methods of measuring and drawing sides and angles were explained. Enough drill work was done. Charts and models were prepared.

Causes of Errors in Arithmetic and Remedial Measures

Causes	*Remedial Measures*
(1) Lack of knowledge of the place of digits and hence the failure in reading decimal numbers.	(1) The value of the places of digits was explained by forming a table. Importance of the decimal point was explained. **A booklet for self-study on decimal numbers was prepared, cyclostyled and was given to each student.**
(2) Lack of comprehension in the process of average numbers.	(2) Many such examples were done on the blackboard and the computational process was explained. **Drill work from self-study booklet on "Average" was given.**
(3) Lack of comprehension of the processes to be used in finding percentages and in comparing various results.	(3) Drill work was done. **The booklet "Programmed Learning on Percentage"** was given to students for self-study and understanding the required computational processes.

Evaluation and Observations

As it is not possible to give the evaluation of all the 59 students, four Sample results of the class are given in the table given below. The investigator gave in all twelve examinations during the whole year, which included eight diagnostic tests, two, terminal examinations and one annual examination.

RESULTS OF THE SCHOOL EXAMINATIONS

Examination Result		Pass	Fail	Total
1. Annual Exam. of Standard	VII	29	30	59
2. I Terminal Exam. of Standard	VII	30	29	59
3. II Terminal Exam. of Standard	VIII	38	21	59
4. Annual Exam. of Standard	VIII	44	15	59

ANNEXURE–A

AN INVITATION TO THE GUARDIANS

Sir,

As you know that the experiment of "The Diagnostic Tests in Mathematics in Standard VIII C" is going on, you must be acquainted with the progress of your child uptil now. We try our best to give full co-operation to your child, but in this work, we also are in need of your co-operation and we require to know some of the details of your child. Hence I request you to see me on Saturday or Monday during the school hours, i.e., from 8-30 A.M. to 11-00 A.M.

Yours faithfully,

30-1-1969.

ANNEXURE–B

INFORMATION SHEET OF THE PUPILS, 1968-69

N.B. :—Answer the following questions honestly.

(1) Name of the student ——————
Surname, Name, Father's name.

(2) Age————years.

(3) Underline the subject which you like the most: English, Mathematics, Science, History, Geography, Gujarati, Hindi.

(4) The reasons for lack of interest in Mathematics :

(5) How much time do you spend in study at home ?———hours.

(6) How much time do you spend for home work in Mathematics ?———hours.

(7) Are you interested in extra reading ? ———

(8) Underline the type of extra books you read : Drama, Novels, Detective Stories, Incidents, Religious books, etc.

(9) How much time do you spend in extra reading ?———

(10) How many friends have you ?———

(11) Write the name of one of your good friends ?———

(12) Does your friend study in your class? ———

(13) If not, in which class does he or she study?———

(14) How many hours do you spend with your friend?———

(15) Does your friend help you in your study of Mathematics?———

(16) Do you go with your friend to see a cinema, or a drama ?———

(17) How many pictures do you see, in a week, in a month or in a year ?
——— in a week, ——— in a month,
——— in a year.

(18) Write the name of the game which you like the most ?———

(19) Do you do exercise daily ?———
How much time a day ?——minutes.

(20) Do you live in your own house, or in a rented house ?———

(21) How many rooms are there in your house ?———

(22) Is there any special accommodation for study in your house ?———

(23) State the total income of your family : (1) Below Rs. 200 p.m.—, (2) between Rs. 200 to Rs. 400 p.m. or (3) more than Rs. 400 per month.———

(24) Does your father or mother or both serve ?———

(25) How much has your father studied ? ———

(26) How much has your mother studied ? ———

(27) How many members are there in your family ?———

(28) Are you the eldest in your family ? ———

(29) How much your brothers or sisters have studied ?———

(30) Does any member of your family help you in your study?

(31) Do you study in the presence of any member of your family?———

(32) Have you kept any tutor at home? ———

(33) Please write the name of your teacher? ———

(34) Will you like to study more about Mathematics on Sunday and other holidays?———

(35) Have you the hobby of sewing, knitting or embroidery?

(36) In which extra activities of the school, do you take part in?———

(37) State the extra hobbies?———

(38) Are your eyes weak?———

(39) Can you read the writing on the blackboard from your seat in the Class? ———

(40) Do you write with your left hand or with right hand?

ANNEXURE–C

SELF-STUDY EXERCISES IN ARITHMETIC

Topic: Profit and Loss

Project Class: Standard VIII C.

Leaflet I.

Friends,

You possess some elementary knowledge of "Profit and Loss", as you have learnt it in Standard VII. Let us revise it.

Ex. (1) A merchant sells a bicycle at Rs. 250. If his cost price is Rs. 200, what will be his profit or loss?

Explanation:

You know that the merchant buys the bicycle at Rs. 200. So his cost price is Rs. 200. He sells it at Rs. 250, so his selling price is Rs. 250. If selling price is more than the cost price, the subtraction of the cost price from the selling price gives the profit or gain. **The rule is:**

(1) Selling Price–Cost Price=Profit.

In this example Rs. 250 selling price—. Rs. 200 cost price=Rs. 50 Profit. **Answer:** Profit of Rs. 50.

Ex. (2) Ila buys a pen for Rs. 5. After some days she does not like its colour. She sells it to Sudha at the price of Rs. 4. What is her profit or loss?

Explanation:

Here Ila's selling price is less than her cost price. So she makes a **loss.**

Rule (2) Loss=Cost price–Selling price.

So Ila's loss:=Rs. 5–Rs. 4=Re. 1.

If we want to express the profit or loss into a percentage, we have to calculate the profit or loss on the base of Rs. 100 cost price.

Ex. (3) Find out the percentage profit of the merchant in example (1).

If the cost price is Rs. 200, the merchant makes a profit of Rs. 50, what will be his profit, if his cost price would be Rs. 100?

Rs. Cost Price	Rs. Profit
200	50
∴ 100	(X)

$$\frac{\overset{25}{100\times50}}{200}=25 \text{ per cent profit.}$$

Ex. (4) Find out the percentage loss of Ila in example (2).

In example (2), the loss of Ila is Re. 1. The cost price of the pen is Rs. 5. So, if.

Rs. Cost Price	Rs. Loss
5	1
∴ 100	(X)

$$\frac{\overset{20}{100\times1}}{5}=20\% \text{ loss.}$$

Remember the following rules:

(1) Selling price–cost price=profit.

(2) Cost price–selling price=loss.

(3) Cost price+profit=selling price.

(4) Cost price–Loss=Selling price.

(5) Selling price+Loss=Cost price,

(6) Selling price–Profit=Cost price.

N.B. : Certain expenses such as the repairing charges, excise duty, labour charge, etc., are added into the cost price. The total cost price would be the real cost price.

Self-study

Exercise (1)

Example (1). A man bought a watch for Rs. 24. He spent Rs. 6 as the repairing charge. He sold it for Rs. 38. What will be his profit in percentage?

(Ans. 26-2/3 per cent profit).

Example (2). A man bought an old house for Rs. 12,500. He spent Rs. 1,500 on repairs. But due to certain circumstances he sold it for Rs. 13,300. What will be his loss in percentage?

(Answer 5 per cent loss).

Example (3). A merchant buys 100 quintals of sugar at the rate of Rs. 96 per quintal. If he sells it at Rs. 1.04 paise per kilogram, what will be his profit in percentage?

(Answer 8-1/3 per cent profit).

Example (4). A milkman adds 8 litres of water in 40 litres of milk. Then he sells it at the cost price. What will be his profit in percentage?

(Answer 20 per cent profit).

The teacher had written the **"Second Leaflet"** on finding the cost price or selling price. In this way he prepared all the subtopics of Arithmetic.

ANNEXURE D–1

"PROGRAMMED LEARNING"–IN ARITHMETIC

Topic : Percentage.

This method was used as a method of classroom-teaching. The teacher prepared a booklet on the topic : "Percentage". It was cyclostyled and was given to each pupil in the class. Four to five periods were devoted to this topic. The students learnt the pages by themselves. The teacher had not to teach anything in the class as usual. **The students had to be active while studying. They had to answer every small frame. The teacher was required to give least guidance, because the booklet was self-explanatory.**

First, the teacher laid out the specific objectives of the topic :–

(1) The students may understand the meaning of "Per cent".

(2) They may be able to compare certain quantities by converting them into percentage.

(3) They may express a fraction into per cent, and vice versa.

(4) They may develop the computational skill.

(5) They may apply their knowledge to the day-to-day problems and so on.

The teacher then explained how to use and read the frames carefully.

If the student fails to answer any frame, he must refer to the foregoing frames carefully.

The teacher divided the topic 'Percentage' into 46 small frames. At the end of the topic, he gave 10 examples to test their knowledge by themselves. He explained all the examples fully, so that students get the correct knowledge about the topic.

A few of these frames are given below :

(1) Friends,

You know that a money lender takes an interest of Rs. 5, if he lends a sum of Rs. 100 to a farmer for one year.

In practice, 100 is such a number which can be divided or multiplied easily.

If any quantity is calculated on the base of 100, it is said to have been expressed in percentage.

If any quantity is calculated on the base of 100, the result is known as——————

---

(1) Per cent.

---

(2) 100 is known as a century. If a thing is divided into 100 equal parts, and if we take 5 parts out of it, we call it 5 per cent or 5 parts out of a hundred.

$$\therefore \text{ 5 percent} = 5 \times \frac{1}{100} = \frac{5}{100}.$$

The per cent is written as % in practice.

25 per cent=25%

Now answer the following question :

$$25\,\% = 25 \times \frac{1}{100} = \overline{}$$

---

(2) $\frac{25}{100}$

---

(3) 15 per cent means———

15 percent $= \ldots\ldots \times \frac{1}{100} = \frac{\ldots\ldots}{100}$

35 per cent is shortly written as—

75 per cent is shortly written as—

---

(3) 15 parts out of 100 parts.

$15 \times \frac{1}{100} = \frac{15}{100}$

35%

75%

Here the student has to think over the answer. If he fails, he refers to the foregoing frames. First he has to hide the answer given on the left hand side, just below the frame, with a foot rule or a compass box.

After filling the gaps or writing the answer, he compares his answer with the answer given on the left hand side. If his answer is right, he gets a "prompting" and proceeds further.

This method is so interesting and lucid that the student forgets the surrounding situations and goes on answering frames one by one till the end. There is also a self-study test for him.

The whole work on "Programmed Learning" on the topic "Percentage" is expressed in Gujarati.

ANNEXURE D–2

"PROGRAMMED LEARNING"– IN ALGEBRA

Topic: "Self-Study of Algebra"

Through Programmed Learning

This booklet was given to the students for "Revision Work" in Algebra of Standand VIII in the month of March, 1969.

The booklet created great interest in the students for Algebra. In the booklet, the whole course of Algebra is divided into 150 small graded frames. At the end there is a self-study test for the students.

The original booklet is written in Gujarati.

ANNEXURE E–1

THE FIRST DIAGNOSTIC TEST IN MATHEMATICS FOR STANDARD VII

Topics: Simple and Compound Interest, Ratio, etc.

N.B.: 1. **There is no time limit to this test. Try to finish all the questions.**

2. **Show your method of calculation on the opposite blank side. Do not rub it.**

3. Write your answers only on the space given at the end of each question.

Question No.	1	2	3	4	5	Remark
Total Marks.						
Marks obtained.						

Note of the mistakes or wrong concepts of the pupils :———

Question I : What is the simple interest on a sum of Rs. 600 for 4 years, at the rate of $4\frac{1}{2}$ per cent ?

(a) Interest on Rs. 600 for 1 year Rs.–

b) Interest on Rs. 600 for 4 years Rs.–

Question II : What is the compound interest of Rs. 400 for 2 years at the rate of 5 per cent ?

Ans. Rs.———

Question III : Fill up the blanks :

(A) The ratio of the two numbers is 5 : 8. If one number is 24 cows, the other number is———cows.

(B) 6 : 9 : : 12 :———

(C) 3 : 2 : :—— :30.

(D) If 23 chairs cost Rs. 207, the cost of 5 chairs is Rs.———.

Question IV : Veena, Lata & Pushpa started a business with equal shares. If the invested capital is Rs. 13,500, what is the amount invested by each ? If they made the profit of Rs. 3,240, what will each get ?

(a) The total shares of Veena, Lata and Pushpa are———.

(b) The invested amount of Veena is Rs. ———, and her profit is Rs.———.

(c) The invested amount of Lata is Rs.——, and her profit is Rs.———.

(d) The invested amount of Pushpa is Rs. ———, and her profit is Rs.———.

Question V. A tank of water is filled by pipe A in 10 hours, and by pipe B in 8 hours, but it is emptied by C pipe at the bottom. How much time will be taken to fill it if all the three pipes work together ?

(a) ———part of the tank is filled by A pipe in one hour.

(b) ———part of the tank is filled by B pipe in one hour.

(c)———part is emptied by C pipe in one hour.

(d) The whole tank is filled in——hours by three pipes working together.

ANNEXURE E–2

The Second Diagnostic Test in Arithmetic for Standard VIII

Topics : Decimals and Approximate Numbers

N.B. : Instructions were given as shown in the first Diagnostic Test.
The table of record of marks and errors was printed as shown in the first Diagnostic Test.

Q. 1. A. Write down the following decimal fractions in words :

46.57———
11.008———
0.008———
3.40261———

B. The bigger number in 4.07 and 4.007 is———
The smaller number in 8.799 and 87.8
———

C. Multiply the following decimal numbers with the whole numbers **orally.**

4.673 x 10=———
4.0983 x 100=———
38.02 x 1000=
0.018034 x 10000=———

D. Divide the following decimal numbers with the whole number orally :

$15.6 \div 10 =$———
$4.93 \div 100 =$———
$0.08 \div 1000 =$———
$5.03 \div 10000 =$———

Question II : Show method of working the following examples, and only write their answers in the given blank space :

A. Simplify :

$1.6+0.16+0.016+16=$
$13.417+46.3015+399-4.0571=$———
$12.7 \quad 12.07-0.009=0.009=$———
$20-0.0261+2=0.2-0.01+11.1=$——

B. Simplify :–

$$\frac{0.15 \times 4.8}{1.2 \times 0.3} = \text{———} \qquad \frac{1.405 \div 28.1}{2.1 \div 6.3} = \text{———}$$

$$\frac{0.98 \div 3.5}{0.08 \times 2} = \text{———} \qquad \frac{3.15 \times 13.5 \div 3.57}{49.5 \times 3.6 \div 18.7} = \text{———}$$

Question 3. A. Write down the following numbers approximately upto hundreds :

479=———
5749=———
10935=———
1983=———

B. Write down the following terms approximately as directed in the brackets. :

679 (upto a thousand)=———
192081 (upto a ten thousand)=———
Rs. 2.06 (in whole rupees)=———
Rs. 707.70 (in whole rupees)=———
16 kilometres 7 Hectometres (upto kilometres=———
$4\frac{3}{8}$ (into whole numbers)=———

Question 4. Show the method of calculations on the opposite blank page. Write here only answers :

A. A student spins 240 threads a day. How many thousands will he spin in 30 days?

B. 4/14=0.307692———. Write down its value up to 4 decimal points. Ans.— The difference between the original number and the arpproximate number is
———

Question 4. A. Write down the significant figures in the following.

In 3.24975, the first significant number is———

In 0.8025, the second significant number is———.

B. $\frac{11}{21}$=———**upto 3 significant number**

ANNEXURE E–3

The Third Diagnostic Test in Geometry for Standard VIII

Topics: Angles, Directions, Maps

N.B.: The instructions were given as shown in the first Diagnostic Test.

The table of record of marks and errors was printed as shown in the first Diagnostic Test.

Quesction I. A. Find out the kinds of the angles given below :–

∠ C=147° Ans.______

∠ B=281° Ans.______

∠ D=89° Ans.______

∠E=180° Ans.______

B. Draw ∠ ABC=123°, and divide it. Draw the figure on the opposite page. Write down the method of division here:

____

____

____

C. If one of the two adjacent angles is 32°, its complementary angle is——degrees.

D. If one of the two adjacent angle is 122°, its supplementary angle is——degrees.

Question II. A. Draw a neat diagram of the Mariner's Compass, with 16 directions. Answer the following questions with its help.

(1) The angle is of———degrees between the North and the South.

(2) The angle is of———degrees between the North and South-East.

(3) Manu stands in the North. He turns to the left side to see the South-West. He turns———degrees of the angle.

B. Draw the following directions on the opposite page:

(1) N.70°E. (2) N.40°W. (3) S.85°W. (4) S.40°E.

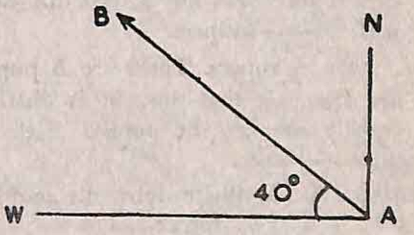
Question III. A. Draw the map of travelling on the opposite page:

A band of pupils start from A and goes to B in the east at the distance of 700 metres. Then they go to C in the S.40° E. direction at a distance of 600 metres. (Scale: 100 metres=1 c.m.) The distance between A and C is———metres.

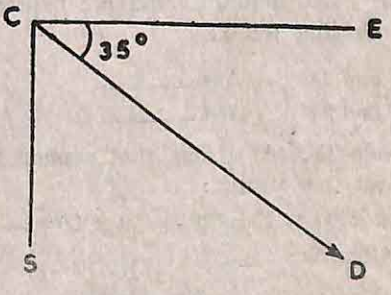
B. A boy sees the North. He rotates to the right side at the angle of 106°. Find its new direction.

Ans. His new direction is———.

C. Write the following direction correctly:



Ans: The direction of AB is————.



Ans: The direction of CD is————.

ANNEXURE E–4

The Fourth Diagnostic Test in Algebra for Standard VIII.

Topics: Formulae and Brackets

N.B.: The instructions were given as shown in the First Diagnostic Test.

The table of record of marks and the wrong concepts was printed as shown in the First Diagnostic Test.

Question I. A. Write down the following rule of the Geometry as a Formula:

The area (a) of a rectangle is expressed as the multiplication of the length (L) and breadth (B).

∴ Its Formula: A=———

B. Write the formula of converting metres (M) into Centimetres (C) Ans. C=———

Question II. (A) A labourer gets A rupees per day. If he works for B days, his earning will be———rupees.

(B) I have A rupees. There are B pupils in my class. If that amount is distributed equally among the pupils, each pupil gets———paise.

Question III. (A) Write down the multiplication in a short form:

3 x 3 x 3 x 3=

7 x a x a x a=

(B) If x=5, find the difference between the following terms:

x^2 and 2^x Ans.———

x^3 and $3x$ Ans.———

Question IV. (A) Using the common factors find the answer:

19 x 51+ 19 x 29 + 19 x 20=———

(B) Simplify:

$X^2(X+5)$ =———

$3Y(Y^2+Y+3)$=———

Question V. Simplify removing the Brackets:

(1) $7x-\{y-(3x+y)\}=$———

(2) $3x^2-x[4\{y-(x+y)\}+x+5]+11$

Ans.———

ANNEXURE E–5

The Fifth Diagnostic Test on Arithmetic for Standard VIII

Topics: Average and Percentage

N.B.: Instructions, record of marks, and wrong conceptions noted down as in I Diagnostic Test.

Question I. Fill in the blanks:

(1) The average of 14, 18, 22, 8, 10 and 12 is———

(2) $\frac{2}{5}$ =———per cent.

(3) 5%=———in fraction.

Question II. The rainfall of a certain city is as follows during the four years:

80.1 c.ms.; 73 c.ms.; 67.8 c.ms.; and 70.3 c.ms. Find average of the rainfall per year.

Ans.———c.ms.

Question III. A motor manufacturing company keeps the cost at Rs. 8,500 of each motor, and gives 12% commission to the salesman. What amount of commission will he get, if he sells 5 motors?

Ans. Rs.———

Question IV. Sudha gets 490 marks out of 700 in the S.S.C. Examination. Meena gets 556 marks out of 800. Who is the better candidate? Why?

Ans.———

Question V. There is 3,60,000 litres of water in a pond. If 5% is evaporated, 20% of the water is sucked by the ground and 4% is dusty, the amount of water available for drinking is———litres.

ANNEXURE E–6

The Sixth Diagnostic Test on Geometry for Standard VIII

Topics: A Triangle, A Polygon, and a Quadrilateral Construction :

N.B. : Instructions to the candidates, record of the result and wrong concepts are noted down as in I Dig. Test.

Question I. Fill in the blanks :–

(1) The sum of the angles of a regular polygon is ——right angles.

(2) The sum of the angles of a triangle is ——degrees.

(3) If the sides of a regular polygon are extended in order, the sum of exterior angles is equal to——right angles.

(4) If one of the base angles of an isosceles triangle is 35°, its top angle is—— degree.

Question II: Write False or True against each of the following statements :

(1) Two triangles are congruent, if their three corresponding angles are equal. (........).

(2) Two triangles are congruent, if their corresponding sides are equal. (........).

(3) The opposite sides of a parallelogram are not equal. (........).

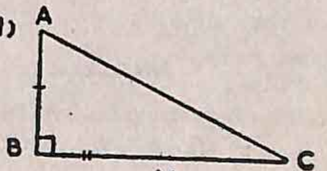
Question III. Draw a quadrilateral ABCD with the help of the following measures: AB=8.2 c.ms.; BC=AC=7.5 c.ms.; Angle A=100° and BD=9.5 c.ms. Write your construction. Find angle D Ans.—— degree.

Question IV. Draw a square ABCD with the help of the following measures :

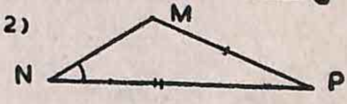
AB=4.5 c.ms. The diagonal AC=...... c.m.s. Write down your construction.

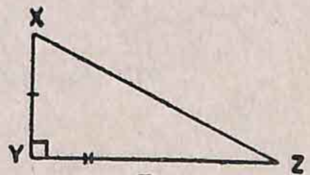
Question V. Which pair of the following Triangles is congruent ?

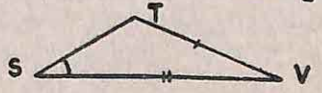
(1)



(2)







ANNEXURE E–7

The Seventh Diagnostic Test On Algebra for Standard VIII

Topics: Values, Equations, Addition and Subtraction

N.B.: Instructions to the students, record of the result and wrong conceptions were noted down as in I Dig. Test.

Question I. Show the method of calculation on the opposite side:

prove that 2 is the root of the equation $10x^4+52x^2+10=63x\,(x^2-1)$.

Question II. Solve the following equation:

$\frac{Y-1}{3}+4=9-\frac{2}{5}\,(3y-2)$. Ans.________

Question III. A. Find the sum of the following expressions:

$2x^3-1-3x^2$; $5x^2-3x+4x^3$; and $7-5x+2x^2$.

Ans._____

B. Find the value of:

$\frac{(+2)^5+(-2)^5}{(+2)^5}$ Ans.________

Question IV. (A) Subtract $16-3x^2+5x-4x^3$ from $x^3-7x+8x^2+21$ Ans.________

(B) The measures of the three angles of a triangle are A c.ms., 2A+5 c.m.s.; and 9–A c.ms. If the sum of the three sides of a triangle is 24 c.ms.; find the length of each side:

Ans._____, _____, _____.

Question V. Fill up the following gaps:

(1) 3x is greater than –3x by______

(2) The middle term of the two terms 90 and–30 is_____.

(3) If______is subtracted from O, we get______.

(4) $4x\ +5x=0$ $x=$_____.

(5) $(+3)\times 0=$_____

(6) $(+2+)\times(-5)\times(\ldots.)=(+\ 100)$

(7) $\frac{(-3)\times(+8)}{(+4)\times(-1)}=$\________.

(8) $\frac{(+x)\times(-x)}{(-x)}=$\________.

ANNEXURE F–1

THE EIGHTH DIAGNOSTIC TEST :

Diagnostic Test on Arithmetic for Standard VIII

Topic : Decimals, Fractions

N.B. : Instructions to the students, record of the result, and wrong concepts were noted down as shown in the I Diagnostic Test.

Show your method of calculations on the opposite blank page.

Question I. (a) Write down the following decimal number in words :–
125.4261 (Mark 1)

(b) Write the following number in decimal : Seven points two zero four five (Mark 1)

Question II. Express in decimal numbers

(A) 74; (B) $\frac{57}{125}$ (Marks 4)

Question III. Write correct answers by choosing them from table B, against the sums in table A. (Marks 5)

TABLE A

(A) 1728 x 0.002
(B) 1.728 ÷ 1000
(C) 0.1728 x 1000
(D) 0.16 x 0.16–0.06 x 0.06
(E) 3.21 x 3.21+1.79 x 1.79

TABLE B

(1) 22
(2) 0.022
(3) 34.56
(4) 3.456
(5) 172.8
(6) 13.5082
(7) 0.001728
(8) 1350.82

Question IV. Multiply 1.23456 by 0.00081. (Marks 2)

Question V. Divide 0.323 by 62.5 (Marks 2)

Q. VI. Simplify : $\frac{3.6 \times 3.24 \times 0.0025}{0.009 \times 2.7 \times 0.15}$ (Marks 3)

Q. VII. $\frac{0.504 \times 0.011977 \div 1.7}{0.0042 \times 2.03 \div 0.34 \times 1.9}$ Simplify

(Marks 3)

Question VIII. What should be subtracted from

$$\frac{0.0188 \times 0.078}{36.66} \times \frac{40.5}{0.135} \text{ to get } 0.005 \text{ ?}$$

(Marks 4)

ANNEXURE F–2

The VIII Diagnostic Test : Diagnostic Test on Algebra

Topics : Algebric numbers; Directed numbers; Simplifications; Addition, Subtraction, Division, and Expansion

N.B. : Instructions to the students; record of the result, and wrong conceptions were noted down as shown in the I Diagnostic Test.

Show your method of calculation on the opposite blank page.

Question I. Fill in the blanks :

(1) The letters of the alphabet are used to show———numbers.

(2) The powers of the digit in the number x^2, x^3, x^4 are———, ———and ———.

(3) If $a = 3$, the values of $3a^2$ and $(3a)^2$ are ———and———respectively.

(4) $a+(b+c)=$________

(5) $a-(8-a-5)=$________

(6) $5m-\{m+(2-\overline{m+3})\}$

(7) If the debt is of Rs. 2, It means Rs.______

(8) $(+6)+(-6)=$______

(9) $5+0=$______

(10) $(-3)\times(-4)=$ ______

(11) $\frac{+15}{+3}=$______

(12) $\frac{-20}{-5}=$______

(13) Solve the equation $3m=10-2m$. Ans.

(14) When 4 is added to a number multiplied by 5, gives 24. Find the number. Ans.———.

(15) $7m^2n \times 5mn^2=$______

(16) $(m+n)\,(m+d)=$______

(17) $(5m-3n)^2=$______

(18) $103\times97=$______

And many others.

ANNEXURE F–3

The Eighth Diagnostic Test : Diagnostic Test on Geometry for Standard VIII

Topics : Angles; Triangles; Constructions; Directions; Theorems; Riders :

N.B. : Instructions to the students, record of the result and wrong conceptions of the students were noted down as shown in I Diag. Test

Show your method on the opposite blank page.

Question I. Fill in the blanks, by selecting the proper number or **words from the brackets.**

(1) Each angle of a regular triangle is——— (50 degrees; 60 degrees; 90 degrees).

(2) In the triangle ABC, the angle B is the greatest.

∴ Its greatest side is———(AB, BC, CA).

(3) The triangle ABC has angle A=angle B=70°.

The triangle is called an———triangle) (Equilateral, unequal, isosceles).

Question II. Draw the triangles on the opposite page with the measures given below :

State giving reasons if they are congruent or not.

(1) Triangle ABC has BC=8 c.ms.; AB =7 c.ms. and AC=6 c.ms.

(2) Triangle XYZ has xy=7 c.ms.; XZ =6 c.ms. and Angle X=50°.

Ans :———Reasons :———

Question III. Two boys are standing at A. One boy moves in the direction N. 48° W. The other moves in the direction S. 48°W. If both the boys have travelled the distance of 100 metres each, find their new directions and the distance between them.

Ans.———and———metres.

Question IV. Draw the prallelogram on the opposite page. Give the construction. The parallelogram ABCD has AB=6 c.ms. BC=4 c.ms. and angle A=56°. Find AC. Ans. AC=———c.ms.

Question V. (A) If two straight lines bisect each other, prove that the opposite angles are equal.

(B) XD and YD are the bisectors of the angles formed by standing CD on AB. Prove that the angle XDY=90°.

ANNEXURE G–I

FIRST TERM EXAMINATION

Date 5-9-1968 Thursday Standard VIII Time : 12-30 to 2 P.M.

Elementary Mathematics

Question I. Fill in the blanks: (Marks 6)

(1) The diameter of the moon is 3470 kilometres. It is approximately—— thousand kilometres.

(2) The value of $10^1 \times 1^{10}$ is_______.

(3) The triangle ABC has angle A= 50°, angle B=90°. If BC is extended outside upto M, the exterior angle ACM so formed is of——degrees.

Q. II. (A) Simplify: 24.96–16.845+29.005–29.12 , (Marks 4)

(B) Express $\frac{13}{10}$ into a decimal number approximately up to 4 decimal points. (marks 5)

(C) Find the difference between 473457894 Miligrams, and 4478567 grams. Express your answer in Kilograms.

Question III. (A) Simplify by removing the brackets. (Marks 5)

$$2x-3\,[y-\{3a+2x-(3y-a-y+x)\}]-12a.$$

(B) If a=9, b=7, find the value of $\frac{a^2-b^2}{a+b}$ (Marks 4)

(C) Find the value of 112 x 7–12 x 7 (Marks 2)

(D) Find the formula of converting hours into minutes. (Marks 2)

Question IV (A) Amala goes to the house of Bakula in the north at the dist. of 660 metres. From there both of them go to the Kamala Park in the east of a distance of 880 metres. Take the scale 110 metres=1 c.m. and draw the plan. Find the direct distance of the Kamala Park from the house of Amala. (Marks 5)

(B) Draw the triangle ABC having AB =6 c.ms., BC=8.2 c.ms. and angle B=58°. (Marks 5)

(C) Draw the diagrams of the following directions: (1) N.62°E., (2) S.71°W. (Marks 3)

ANNEXURE G–2

Second Term Test

Date : 8-1-69. Wednesday. Standard VIII.
(Time 4-15 to 5-45 P.M.)

Elementary Mathematics

Question I. Fill in the blanks: (Marks 6)

(1) 20% of 40 kilograms=—— kilograms.

(2) If 20% of profit is done on selling an article at Rs. 90 its cost price is =

(3) 10th number after (+3+ is——.

(4) $2+(-2)^2=$————.

(5) If the sides of the exterior polygon are extended outside in order, the sum of all the exterior angle is—— right angles.

(6) In triangle ABC, AB=AC and angle A=54°.
∴ Angle B=———degrees.

Question II (A) A man gives 25 per cent of his income in rent. He has Rs. 282 after that. Find his income.
(Mark 4)

(B) There are 35 boys in a class. Their average weight is 40 kilograms. If the weight of the teacher is added, the average becomes 41 kilograms. Find the weight of the teacher?
(Marks 4)

(C) A bought a house for Rs. 24,000. He sold it to B with the profit of $12\frac{1}{2}\%$. B sold it to C with the profit of $2\frac{1}{2}\%$. Find the price of that house given by C.
(Marks 5)

Q. III. (1) Solve the equation : $\frac{y-1}{4}=\frac{2y-1}{9}$
(Marks 4)

(2) Add together : $2a^3-1-3a^2$; $5a^2-31+4a^3$ and $7-5a+2a^2$.
(Marks 4)

(3) If a=2, b=1 and c=−3, prove that $a^3+b^3+c^3=3abc$.
(Marks 4)

(4) Subtract $31-5b+4c$ from $5a+3b-2c$
(Marks 2)

Question IV. (1) Define a regular figure and polar symmetry.
(Marks 2)

2) Find out the sum of all the angles
(i) of a polygon having 11 sides and
(ii) of a polygon having 15 sides.
(Marks 4)

(3 Drawing a quadrilateral ABCD, having AB=6 c.ms., BC=7 c.ms., CD =9.5 c.ms., DA=7.5 c.ms. and angle A=95°. Find AC. Write your construction.

ANNEXURE G–3

Annual Examination 1969

Date : 15-4-1969 Tuesday. Standard VIII.
(Time : 7-30 to 10-30 A.M.)

Elementary Mathematics

Question I. Fill up the gaps in the following:
(Marks 8)

(1) 10 per cent of 5 Quintals=——— kilograms.

(2) The population of Madras is 17,25,216. This is approximately—— lakhs.

(3) (x + 2) (x +3)=———.

(4) If n=5, m=2, $n^2-m^3=$————.

(5) The root of the equation x +5=10 is———.

(6) If two congruent triangles ABC and XYZ have AB=XZ, BC=XY, then angle B=angle———.

(7) The complementary angle of the angle whose supplementary angle is 135° is———.

(8) An isosceles triangle has the greatest angle of 70°. Its remaining angles are of———degrees.

Question II (A) a school has 300 students. Their average age is 10.25 years. 25 new students are admitted. If the average age of these 25 is 12.5 years, find the average age of all the students?
(Marks 5)

(B) If the price of the cloth is Rs. 7 and 25 paise per metre. find the value of 64 metres and 16 centimentres?

(C) Simplify :–

$$\frac{6.89+.013+13.84+26.7+2.557}{24.96-16.845+29.005-29.12}$$

Question III. (A) Kamla Shankar bought a house for Rs. 24,000. He sold it to Balvantbhai with the profit of $12\frac{1}{2}$ per cent. Balvantbhai sold it to Labhashankar with the profit of $2\frac{1}{2}$ per cent. What will be price given by Labhashankar for that house? (Marks 4)

(B) In a school there are 5 per cent boys Harijans, 4 per cent boys of the backward class, 6 per cent Parsis. and 11 per cent Muslims. How many boys are there in the school, if the remaining boys are 333? (Marks 4)

(C) Convert $\frac{711}{128}$ into a decimal number upto 3 decimal digits. (Marks 3)

Q. 4. (A) If $m=5$, $n=3$, find the value of

$$\frac{m^2+2mn+n^2}{m+n}$$

(Marks 5)

(B) Solve the equstion :

$$\frac{7x-11}{8}-\frac{9x-17}{10}=\frac{7}{20}$$

(Marks 4)

Q 5. (A) Simplify : (Marks 5)

$$2-[3x-\{2x+5(x+3)+7\}+2x+9]-(2x-5)$$

(B) Add togother : (Marks 5)

$3x^2-x^3+2x-1$; $2x^3-7x+3+2x^2$; $9x+4x^2-8$ and x^3-8x^2+5x+4.

Q. 6. (A) Divide $x^3+x^2-17x+15$ by $x-3$. (Marks 3)

(B) Join section M with section N properly. (Marks 5)

M section	N section
(1) The sum of all angles at a point in right angles.	1
(2) $\frac{1^{10} \times 10^1}{10}$	2
(3) 3^2-2^2	3
(4) The sides of a regular polygon having one angle of 60°	4
(5) 8% of 25 Rs.	5

Q. 7 (A) If a triangle has two angles equal prove that the sides opposite to those angles are equal. (Marks 4)

(B) If a triangle ABC has AB=AC, and angle B is equal to twice angle A, find its angles. (Marks 3)

(C) Draw a triangle ABC in which angle A=30°, angle B=114° and BC=7 c.ms. Write your construction.

Question 8. (A) If a straight line stands on another straight line, the sum of the two adjacent angles is equal to two right angles. (Marks 4)

(B) In a compound a mango tree is at a distance of 250 metres in the north of a Kadamb tree at A. The asopalav tree is at distance of 250 metres in the south of the mango tree. Draw the map. With scale 25 metres=1 centimetre. (Marks 4)

(C) Draw a quadrilateral ABCD having AB=BC=CD=6 c.ms., AD=4.5 c.ms. and AC=7 c.ms. Measure angle C. Write your construction. (Marks 4)

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Arithmetic

1. Aadhunik Madhyamik Ankaganit by Desai, Shah, Shukla.
2. Saral High School Ankaganit by Desai and Desai.
3. Maru Madhyamik Ankaganit by Dr. K.G. Desai.

Geometry

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2. Nutan Bhumiti Part I by Kaji and Desai.
3. Nutan Madhyamik Bhumiti Part I by Pandya & Sheth.
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5. Saral Madhyamik Bhumiti Part I and II by N. N. Desai.

APPENDIX I

Extracts from the Speech of Dr. D. S. Kothari, Chairman, U.G.C. at the Time of the Distribution of Awards

I am very happy to be here and I thank Dr. Dave for asking me to be present at this function. It is a great pleasure and indeed a privilege for me to give away these awards. I feel honoured by giving these awards and I think in a way the NCERT is also honouring itself by organising this programme and by making these awards possible.

It strikes me that in a programme of this kind which involves teachers, the categorisation of papers as A, B and C perhaps may not be quite necessary or desirable. I think we all know that one of the basic problems which is confronting education, not only in India but in nearly all countries, is how to reduce the element of competition. At present, right from the Kindergarten stage up to the highest ladder in education the competitive element is very much emphasised. At the same time we expect education to make a direct contribution not only to national productivity but also to social welfare. In other words, we expect education to generate a sense of identification with the community, we expect it to generate a sense of co-operation, and a sense of belonging. Therefore, the problem facing education is how one can keep motivation and incentives, and at the same time reduce or avoid the aspect of competition in education. At present, for instance. take admissions in any highly selective institution. One can only get into such an institution by keeping somebody out, that is, one's performance in the examination is adjudged by what one is doing for one's own self, and not by what one is contributing to the education and progress of his fellow students. Keeping this in view, it seems to me that for a programme of this kind we could think of some suitable way in which this competitive element is not emphasised. In other words, it should be a distinction, not so much for an individual but for the teaching community as a whole. Again, as a teacher I feel that an award is not quite an appropriate word. In the case of teachers, it could be called as joining a membership. Dr. Dave very rightly said that we are building a movement. When somebody is in a programme like this one expects that he will continue his efforts to be associated with it. So, one could even call it a national seminar programme in which one can become a member by making a contribution which is adjudged to be of value for the profession. And then this type of meeting could be an annual meeting of the members and their being admitted into membership. The only difference would be that usually for becoming a member we have to pay something, here the members will be paid something by the NCERT. One could also think of some other ways of bringing in other categories of members, and thus bring a wider body of teachers into this very interesting and very useful programme.

Education to-day has key role in the progress of a nation. There is no other method, no other instrument, and no other key to national progress and prosperity but education. Today's world is knowledge-based. It is a new thing in man's history. It means that every aspect of man's activity whether it be the economic development or national security, or social welfare now depends directly on knowledge and education.

This imposes a special obligation and a special responsibility on educationists and specially on those who are engaged in this great task of building education in our country, that is, all of us assembled in this room. In order to discharge our task properly it seems to me that perhaps the most fundamental thing that is required on the part of all of us is faith and zest. We must have faith in the destiny of our country, and we must have faith in education. Every teacher must have faith, a living faith, in his profession, which should mean that he would regard his vocation as the most fortunate thing that could happen to him in life. To be a teacher, I think, is the most fortunate thing, and so I repeat that one must have a living faith in one's profession, have zest, and be enthusiastic, hopeful and optimistic. If the teacher radiates hope to those around him, and, in turn, hope is fed back to him, then the whole community and society can advance forward.

A programme like this helps to generate and to foster that faith and hope. It provides an opportunity for teachers to get together, to exchange their thoughts, and thus helps to build the morale of each one. By participating in a programme of this kind the teachers' faith is strengthened his zest is increased, and he becomes, therefore, a better and more effective teacher.

When we think of any educational improvement, the crucial problem is not to think gradiose schemes which are beyond our control. The most important thing is to take a step, even a small step, that is within our reach. There is no substitute for actual improvement, however, small. For instance, we all know the famous proverb, 'if one wants to move a mountain, then the way to do it is to start moving the pebbles at your feet.' Do not think of the mountain, start picking the pebbles at your feet. Go on doing that, go on moving the pebbles at your feet, go on doing that throughout your life, and then the generations which follow will do the same and if each one does his work, that is, just lifting the pebbles at his feet, the mountain will be moved. If one does not do this but always looks at the mountain and merely says 'how huge it is' and expects somebody else to go and move it, the mountain will never move. So we must always start looking for the small things which are within our reach. This is also what Gandhiji taught us. Think of what we can do ourselves and if each one of us tries to do that, even from the small contributions, the whole thing is swelled into a mighty stream.

I think it is literally true, it is desperately true that in order to improve education in our country we have to take care of the small things and the big things will take care of themselves. It is small things which are most important because the small things are the things which are within the reach of a very large number of people. And if a very large number of people will make even a very small contribution, the total will far exceed the very large contribution that very few could make. So in any large scale improvement, in any great improvement in a country, the basic thing is a large number of people doing what may be little things, things within the reach, so that each one of them can make a contribution. So it is important for us that in our own sphere, which is always a very limited one, we do not allow any place for pessimism or frustration.

Only that man has a right to feel frustrated who is doing his utmost to make things move forward. But if one is not doing that, then he has no right to feel frustrated because by feeling frustrated not only is he becoming a problem for himself, but he is radiating frustration for others and thus it gets multiplied.

If we want to improve education, we must improve the quality of education and at the same time reduce the cost of education, and the two can go together. We can improve the quality of education by making education more interesting, more useful, more relevant, closer to things and aspirations of the community, and under the Indian conditions very often it will mean, cutting down various unnecessary costs. It is only that education which is isolated from the rest of the community, where we pay no attention to the requirements of the community and to its interests, which is expensive education. The moment we begin to pay attention to the needs and to the resources of the community to the actual problems which face the community, we can always reduce the cost. To improve quality and to reduce the cost we must identify ourselves with the interests of the community. We know that the community is extremely poor. Any little thing we can save would be useful to the community.

For instance while teaching physics, chemistry, or biology and so on, we could improve teaching and the learning process by improvising apparatus, picking up many simple things available in the market, through which a good deal of science, even sophisticated science could be taught. This was not possible, say fifty years ago, because fifty years ago there was not enough basic understanding of the fundamental processes of science. There is no need now to impart science through the process of isolation. Now there is enough basic understanding of many of the every day processes in our life. One can teach a good deal of science, through every day happenings, through the things around us and by improvising a lot of material making the things very interesting and very exciting which will be close to the child's environment and at the same time cut down the cost. The key to cut down the cost is just to think always of the community, think always of the people around us and then we will find how poor and miserable is the condition. If we keep that in view, then we can always think of cutting down the cost.

I mentioned the quality and the cost. I could also give two different names to these —excellence and relevance. Quality is excellence. Excellence not in a narrow sense but to cover a wide spectrum. Excellence would mean, each one trying to strive to do his utmost whether he is a teacher or a student. Cutting down the cost is a part of relevance. It is making the whole educational process more relevant to the needs, resources and aspirations of the community. Excellence and relevance are the basic constituents of participation. We all must work together. This programme is a good example of participation. There are present leaders in the teaching profession, administrators, and all of us teachers here—school teachers, university teachers and so on. It is a fine example of participation. Participation must be meaningful, must be responsible, and must be effective. Everybody must have a faith that he is more or less on equal terms, as it were in participation.

The last point is organisation. There must be an organisation which is adequate, which is effective, which is harmonious and which may be helpful in developing and fostering excellence, relevance and participation. These four things are represented by ERPO. E stands for excellence, R for relevance, P for participation, O for organisation. It is the joining together of these four things that will make our education go forward, and I am sure that all those who have honoured us by becoming the members of this great brotherhood, will make a very valuable contribution to this forward march of Education.

APPENDIX 2

List of National Awardees of VIII Competition of Seminar Readings (1969-70)

Sr. No.	*Name*	*Designation*	*Address*
1.	Smt. M. S. Kanthamani	Teacher in Social Studies	Demonstration Multipurpose School, Regional College of Education, *Mysore-6* (Mysore State)
2.	Shri K. R. Ghorpade	Headmaster	Jubilee Girls English School, *Miraj* (*Sangli*) (Rajasthan)
3.	Shri O. P. Sharma	Teacher	Demonstration School, Regional College of Education, *Ajmer* (Rajasthan)
4.	Shri G. Madhava Rao	School Assistant	Govt. Multipurpose High School for Boys, *Nampalli* (Andhra Pradesh)
5.	Shri K. Murthy	Teacher	Demonstration School, Regional College of Education, *Mysore-6* (Mysore State)
6.	Shri G. Sinhgvi	Headmaster	Shri Sumati Shiksha Sadan Secondary School, *Ranawas* (*Pali*) (Rajasthan)
7.	Shri J. S. Chokshi	Principal	Navrachana School, *Baroda* (Gujarat)
8.	Shri S. N. Talwar	Headmaster	Sainik School, *Purulia* (West Bengal)
9.	Shri K. R. Udupa	Headmaster	Viveka Hr. Sec. School, *Kota*, S. K. District (Mysore State)
10.	Shri A. R. Modi,	Teacher	Diwan Ballubhai Madhyamik Shalla, Kankaria, *Ahmedabad-22* (Gujarat)
11.	Shri G. R. Sontakey	Teacher	Govt. Multipurpose Hr. Secondary School, *Ashta*, District Sehorey (Madhya Pradesh)
12.	Shri A. Sadananda Hebbao	Headmaster	Chethana High School, *Hangarcatt*, S. K. District, (Mysore State)
13.	Shri A. P. Oza	Headmaster	Karansinhji High School, *Rajkot* (Gujarat)
14.	Shri K.H.S. Veeraiah	Jr. Foreman	Department of Technology, Demonstration School, Regional College of Education, *Mysore-6* (Mysore State)
15.	Shri P. H. Nijsure	Teacher	Ornellas High School, *Poona-1* (Maharashtra)
16.	Shri C. Nanda	Headmaster	B. C. High School, *Ranpur* (Orissa)
17.	Shri V. N. Bhargava	Master	Sainik School, Balachadi, *Jamnagar* (Gujarat)
18.	Shri A. Kumar	Vice Principal	Model Academy, *Jammu* (J. & K.)
19.	Shri A. Gopala Kishnan	Headmaster	S. K. M. J. High School, Kalpetta, P. O. Kalpetta North, Kozhikode District, (Kerala State)
20.	Shri V. M. Oza,	Principal	Asarva Vidyalaya, *Ahmedabad-16* (Gujarat)

शुद्धा हि बुद्धिः किल कामधेनुः

दि मिरज एज्युकेशन सोसायटीची

ज्युबिली इंग्रजी कन्या शाळा, मिरज.

अस्पृश्यता निवारण प्रकल्प

(१९६९-७०)

प्रतिज्ञा पत्रक

मी………………………………………आपल्या ज्युविली कन्या शाळेतील वर्गाच्या तुकडीत शिकत आहे.

आपल्या शाळेत चालू असलेल्या **अस्पृश्यतानिवारण** प्रकल्पास माझा मनापासून पाठिंबा आहे. व त्यात जास्तीत जास्त प्रमाणात सहभागी होण्याचा मी प्रयत्न करीन.

स्पृश्यास्पृश्य भेदामुळे आपल्या समाजाचे व देशाचे फार मोठे नुकसान झालेले असल्याने या अशास्त्रीय रूढीवर मी विश्वास ठेवणार नाही. अस्पृश्यता पाळण्या विरुद्ध शासनाने कायदे केले आहेत व थोर सामाजिक, राजकीय व धार्मिक विचारवंतांचाहि या दुष्ट रूढीस विरोध आहे.

मी गंभीरपणें अशी प्रतिज्ञा करतें की, मी अस्पृश्यता मानणार नाही व समाजात उच्चनीचता निर्माण करणारी व भेद पाडणारी ही रूढी पाळू नये असे मी माझ्या सर्व नातलगांस व इष्टमित्रास सांगून त्यांचे मतपरिवर्तन करण्याचा प्रयत्न करीन.

सर्व भारतीय समान आहेत व ते माझे बांधव आहेत या विचारानेच भारताची एकता व समृद्धता सिद्ध होईल, असा माझा विश्वास आहे.

भारत माता की जय !

मिरज }
दि. }

विद्यार्थिनीची स्वाक्षरी :

शुद्धा हि बुद्धिः किल कामधेनुः

दि मिरज एज्युकेशन सोसायटीची

ज्युबिली इंग्रजा कन्या शाळा, मिरज.

अस्पृश्यता निवारण प्रकल्प

(१९६९-७०)

प्रतिज्ञा पत्रक

आम्ही आपल्या शाळेतील इ. तुकडी मध्ये शिकत असलेली विद्यार्थिनी कु.......................................चे पालक असून आम्हांस आपल्या शाळेत चालूं असलेल्या **अस्पृश्यतानिवारण** प्रकल्पाची माहिती आहे व त्यास आमचा पाठिंबा आहे.

स्पृश्यास्पृश्य भेदामुळे आपल्या समाजाचे फार मोठे नुकसान झालेले असल्याने या अशास्त्रीय रूढीवर आम्ही विश्वास ठेवणार नाही. अस्पृश्यता पाळण्याविरुद्ध शासनाने कायदे केले आहेत व थोर सामाजिक, राजकीय, धार्मिक विचारवंतांचाहि या रूढीस विरोध आहे.

आम्ही गंभीरपणें अशी प्रतिज्ञा करतो कीं, आम्ही अस्पृश्यता पाळणार नाही व समाजात उच्चनीचता व भेद निर्माण करणारी ही रूढी पाळू नये असे आमच्या नातलगांस व इष्टमित्रांस सांगून त्यांचे मतपरिवर्तन करण्याचा प्रयत्न करूं.

सर्व भारतीय समान आहते व ते आपले बांधव आहेत या विचारानेच भारताची एकता व समृद्धता सिद्ध होईल. असा आमचा विश्वास आहे.

मिरज

दि.

भारत माता की जय !

पालकांच्या स्वाक्षऱ्या :

(१)	(५)
(२)	(६)
(३)	(७)
(४)	(८)

"हिन्दी टंकन-यन्त्र की गृह आधार कुंजियों की दोनों विधियों का तुलनात्मक अध्ययन"

(नवीन कुंजी पटल पर आधारित)

—**ओमप्रकाश शर्मा**
प्रायोगिक विद्यालय
क्षेत्रीय शिक्षा महाविद्यालय
अजमेर

(1) समस्या

हिन्दी टंकन अध्यापन की दो महत्वपूर्ण समस्याएँ रही हैं। जिनमें प्रथम स्थान कुंजी-पटल की अनेकरूपता का है तथा दूसरा स्थान कुंजी संचालन की विधियों की अनेकरूपता का है। प्रथम समस्या का हल करने के लिए भारत सरकार द्वारा मानक कुंजी पटल की रचना की गई है। किन्तु दूसरी समस्या आज तक ज्यों की त्यों बनी हुई है।

कुंजी संचालन विधियों में गृह आधार कुंजियों के सम्बन्ध में मुख्य रूप से दो पद्धतियाँ प्रचलित हैं :

(1) बाँयी कनिष्ठा तथा तर्जनी द्वारा बराबर कुंजियों का संचालन;

(2) बाँयी कनिष्ठा द्वारा तर्जनी की अपेक्षा कम कुंजियों का संचालन।

इन दोनों विधियों में गृह-पंक्ति (नीचे से दूसरी) में गृह-आधार कुंजियों का क्रम निम्न प्रकार रहता है—

प्रथम विधि :

कनिष्ठा	अनामिका	मध्यमा	तर्जनी
(ˋ)	(क)	(f)	(ह)

↑———— बाँया हाथ ————↑

तर्जनी	मध्यमा	अनामिका	कनिष्ठा
(ा)	(स)	(य)	(ऽ)

↑———— दाहिना हाथ ————↑

द्वितीय विधि :

कनिष्ठा	अनामिका	मध्यमा	तर्जनी
(˙)	(ˎ)	(क)	(f)

↑———— बाँया हाथ ————↑

तर्जनी	मध्यमा	अनामिका	कनिष्ठा
(र)	(ा)	(स)	(य)

↑———— दाहिना हाथ ————↑

श्री राम कृष्ण व्यास, श्री गया प्रसाद अग्रवाल एवं श्री बी० एल० अजमेरा ने अपनी पुस्तकों में प्रथम पद्धति का अनुसरण किया है, जब कि भारत सरकार द्वारा प्रकाशित "हिन्दी टाइपराइटिंग प्रशिक्षक" में द्वितीय पद्धति का अनुसरण किया है।

छात्रों की गति एवं शुद्धता का विकास अधिकांशतः इस बात पर निर्भर रहता है कि टंकन के समय विभिन्न अंगुलियों पर कितना भार सौंपा गया है। अतः प्रत्येक टंकन अध्यापक के समक्ष यह

समस्या रहती है कि वह गृह आधार कुंजियों का इन दोनों विधियों में से किसका प्रयोग करे।

इसी समस्या को हल करने के लिए अन्वेषक द्वारा दोनों ही पद्धतियों का तुलनात्मक अध्ययन करने के लिए एक प्रयोगात्मक परियोजना चलाई गई।

(2) प्राकल्पनाएँ

निम्न गृह आधार कुंजियों के अनुसार कुंजी-पटल की समस्त कुंजियों का अंगुलियों के अनुसार निर्धारण अपेक्षाकृत अधिक उपयोगी है।

कनिष्ठा	अनामिका	मध्यमा	तर्जनी
(˙)	(ˎ)	(क)	(f)

↑ — — — — बाँया हाथ — — — — ↑

तर्जनी	मध्यमा	अनामिका	कनिष्ठा
(र)	(ा)	(स)	(य)

↑ — — — — दाहिना हाथ — — — — ↑

उपरोक्त व्यवस्था के अनुसार अध्यापन करने की पुष्टि में निम्न मान्यताएँ हैं :

(1) यद्यपि टंकन के दृष्टिकोण से दाहिने हाथ की अपेक्षा बाँया हाथ अधिक प्रभावशाली है, किन्तु अंगुलियों की शक्ति के अनुसार तर्जनी, मध्यमा और अनामिका के बाद कनिष्ठा का स्थान आता है। अतः कनिष्ठा सबसे कमजोर अंगुली होने के कारण इस पर कार्य भार तर्जनी से कम होना चाहिए।

(2) नूतन कुंजी पटल में समस्त निष्क्रिय कुंजियों की व्यवस्था बाँयी ओर ही की गई है। जिनका संचालन बाँयी कनिष्ठा से होता है। निष्क्रिय और सक्रिय कुंजियों की संचालन प्रक्रिया में अन्तर होने के कारण बाँयी कनिष्ठा पर तर्जनी की अपेक्षा कम भार होना चाहिये।

(3) कुंजी-पटल पर बाँये हाथ की कनिष्ठा पर जितनी मात्राएँ निर्धारित की गई हैं उनकी आवृत्ति अधिक होने के कारण बाँयी कनिष्ठा का संचालन अधिक होता है। जबकि इसके विपरीत दाहिनी ओर की कनिष्ठा पर जितने अक्षर और संकेत आते हैं, उनका उपयोग साधारणतः कम होता है। अतः बाँयी कनिष्ठा पर कार्य भार कम होना चाहिए।

(3) कार्य विधि

(क) **छात्रों का चुनाव** : इस परियोजना के लिए छात्रों का चुनाव दो समूहों में किया गया। एक समूह के छात्रों को परिकल्पना के आधार पर अध्यापन कराया गया और उसका नाम नियन्त्रित समूह रखा गया। दूसरे समूह के छात्रों को दूसरी विधि से अध्यापन कराया गया और उसका नाम प्रयोगात्मक समूह रखा गया।

दोनों समूहों के लिए विद्यालय में प्राप्त सुविधाओं के अनुसार 13-13 छात्रों का चुनाव किया गया। छात्रों का चुनाव उनकी बुद्धि क्षमता, अंगुलियों की संचालन शक्ति और उनकी (छात्रों की) गति एवं शुद्धता के स्तर के आधार पर किया गया। साँख्यकीय विधियों के अनुसार दोनों ही समूहों को समान स्तर पर नियन्त्रित किया गया।

छात्रों की बुद्धि क्षमता, अंगुलियों की संचालन शक्ति और उनकी गति एवं शुद्धता को ज्ञात करने के लिए निम्न मनोवैज्ञानिक परीक्षणों का प्रयोग किया गया :

(1) Standard Progressive Matricis
(2) Tweezer Dexterity Test
(3) D. A. T. Clerical (Speed & Accuracy)

(4) सीखने की समान क्षमता रखने के दृष्टिकोण से दोनों ही समूहों में एक समान आयु समूह के छात्र रखे गये। यह आयु समूह 17 से 21 वर्ष तक का लिया गया।

(5) परियोजना के लिए ऐसे छात्रों को चुना गया जिन्हे अंग्रेजी टंकन का तो अभ्यास है; किन्तु जिन्होंने हिन्दी टंकन यन्त्र का कभी प्रयोग नहीं किया है।

(ख) समूहों में विभाजन

छात्रों को दो समूहों में विभाजित किया गया। उपलब्ध सुविधाओं, अध्यापन की कठिनाइयों और

हिन्दी टंकन सीखने वाले छात्रों की सीमित संख्या, के कारण छात्रों को 13-13 के समूहों में बाँटा गया। नेशनल डिप्लोमा इन कर्माशियल प्रेक्टिस के प्रथम वर्ष के छात्रों को प्रयोगात्मक समूह तथा नेशनल डिप्लोमा इन कार्माशियल प्रेक्टिस द्वितीय वर्ष के छात्रों का नियन्त्रित समूह में रखा गया।

(ग) टंकन-प्रयोगशाला और छात्रों के बैठने की व्यवस्था

टंकन प्रयोगशाला टंकन सीखने के दृष्टिकोण से सभी नवीनतम उपकरणों जैसे—(L) आकृति की मेजें, घूमने वाली कुर्सियाँ, प्रदर्शन स्टैंड, कापी होल्डर आदि से सुसज्जित थीं; जिसमें वायु और प्रकाश का समुचित प्रबन्ध था।

छात्रों के अभ्यास के लिए नूतन कुंजी पटल वाले रेमिन्गटन रेण्ड के टंकन यन्त्रों का प्रयोग किया गया। छात्रों के बैठने की व्यवस्था के लिए प्रथम पंक्ति में 5 और शेष दो पंक्तियों में 4-4 छात्र रखे गये।

(घ) अध्यापन सामग्री

अध्यापन के लिए सभी उपलब्ध पाठ सहायक सामग्री का प्रयोग किया गया। उदाहरणार्थ छात्रों को टंकन अभ्यास के सही ढंग का प्रदर्शन करने के लिए डिमोंस्ट्रेशन स्टैंड, समय के लिए इन्टरवल टाइमर, श्याम पट पर प्रयोग करने के लिए कुंजी पटल प्रारूप एवं बाँयी और दाँयी हस्त आकृतियाँ, छात्रों को कुंजियों की स्थिति का अभ्यास कराने के लिए कुंजी अभ्यास पटल आदि।

(च) टंकन अध्यापन विधि

दोनों समूहों के छात्रों को "विविध कुंजी प्रयोग विधि" (स्किप एराउण्ड एप्रोच) के आधार पर अभ्यास कराया गया। प्रतिदिन के अभ्यास के लिए अधरों और संकेतों का चुनाव कुंजियों तक अंगुलियों की पहुँच तथा उनकी भाषा के प्रयोग में आवृत्तियों के अनुसार किया गया।

(कुंजियों तक अंगुली की सापेक्षिक पहुँच तथा अक्षरों और संकेतों की आवृतियों के लिए परिशिष्ट1' तथा '2' देखिए)

कुंजियों के चुनाव के लिए निम्न बातें और ध्यान में रखी गईं

(1) सर्व प्रथम गृह पंक्ति का अभ्यास कराया गया;

(2) कुछ दाहिने हाथ की तथा कुछ बाँये हाथ की कुंजियाँ सम्मिलित की गईं;

(3) प्रतिदिन कुछ कुंजियाँ सुगम पहुँच वाली तथा कुछ दुर्गम पहुँच वाली ली गईं;

(4) कुछ कुंजियाँ गृह आधार पंक्ति से ऊपर की पंक्ति की तथा कुछ गृह आधार पंक्ति से नीचे की ली गईं;

(5) प्रारम्भ में दोनों हाथों की एक ही अंगुली को अभ्यास के लिए नहीं लिया गया;

(6) अभ्यास की जाने वाली कुंजी का प्रयोग कुछ शब्दों के आदि में, कुछ के मध्य में तथा कुछ के अन्त में किया गया गया।

(छ) दैनिक पाठ योजना

दोनों समूहों के अध्यापन के लिए प्रतिदिन 40 मिनट की अवधि के घन्टे का प्रयोग किया गया। समस्त कुंजी पटल को पूरा करने में कुल 22 दिन का समय लगा। जिसमें से 18 दिन अध्यापन के तथा 4 दिन मूल्यांकन के रहे।

प्रतिदिन के 40 मिनट के समय का 5 भागों में विभाजन किया।

1—पूर्वाभ्यास	5 मिनट
2—टंकन तकनीक	5 मिनट
3—नवीन कुंजियों का नियन्त्रण	15 मिनट
4—(प्रत्येक कुंजी का अभ्यास पहले अध्यापक के श्रुतलेख द्वारा और फिर प्रारम्भ के पाठों में प्रत्येक कुंजी का 2 मिनट तक अभ्यास तथा अन्त के पाठों में प्रत्येक कुंजी का एक मिनट तक अभ्यास कराया गया।)	
5—छात्रों द्वारा शब्दों का अभ्यास	5 मिनट
6—सावधि टंकन अभ्यास	5 मिनट

सावधि टंकन अभ्यास के लिए छात्रों द्वारा निर्धारित लक्ष्य के अनुसार टंकन अभ्यास कराया

गया। अर्थात जिन छात्रों की एक मिनट में एक से अधिक अशुद्धियाँ थीं उनका आगामी लक्ष्य शुद्धता रखा गया और जिनकी एक मिनट में एक या उससे कम अशुद्धियां थीं उनका आगामी लक्ष्य गति निर्धारित किया गया।

लक्ष्य निर्धारित करने के लिए छात्रों को प्रूफ रीडिंग का अभ्यास कराया गया। इसके द्वारा छात्र स्वयं अपनी अशुद्धियाँ निकालते थे।

(ज) टंकन अभ्यास सामग्री

हमारे देश में हिन्दी टंकन के लिए मनोवैज्ञानिक सिद्धान्तों पर आधारित अभ्यास सामग्री का अभाव होने के कारण अन्वेषण ने स्वयं टंकन अभ्यास सामग्री की रचना की, जिसकी प्रमुख विशेषताएँ निम्न प्रकार हैं :

1—छात्रों को उत्प्रेरित करने के लिए प्रथम दिन से ही सार्थक सामग्री का समावेश;

2—अभ्यास के लिए छात्रों को स्पष्ट निर्देश;

3—दोनों उपान्तों के मध्य अभ्यास सामग्री को इस प्रकार व्यवस्थित किया गया है कि उपान्त देखकर ही छात्र अपनी अशुद्धियाँ ज्ञात कर सकते हैं;

4—प्रत्येक पाठ के अन्त में तकनीक और अभ्यास के विभिन्न सूत्र वाक्यों के रूप में अंकित हैं, जिन्हें पढ़कर छात्र अपने स्थाई संस्कार बना सकें;

5—पाठ के प्रत्येक भाग का निर्धारित समय अंकित किया गया है;

6—पाठ के प्रारम्भ में पूर्व ज्ञान और नियन्त्रित अक्षरों की स्पष्ट सूचना अंकित की गई है;

7—शब्दाभ्यास के लिए प्रहारों की सीमा क्रमशः 3 से 7 तक निर्धारित की गई;

8—टंकन अभ्यास में लय, गति और शुद्धता के विचार से प्रतिदिन के लिए विविध प्रकार के पूर्वाभ्यास बनाये गये। जैसे—एक ही हाथ पर आने वाले अक्षरों के, क्रमशः दोनों हाथों पर आने वाले अक्षरों के, वर्णमाला के क्रम से, कारक चिह्नों, प्रत्यय और उपसर्गों का प्रयोग आदि।

(झ) अंगुलियों का व्यायाम

मांशपेशियों के विकास के लिए और छात्रों की थकान को दूर करने में अंगुलियों के व्यायाम का महत्वपूर्ण स्थान है। अत: दैनिक पाठ योजना में अंगुलियों के व्यायाम की समुचित व्यवस्था की गई। प्रतिदिन पाठ के प्रारम्भ में दो मिनट तक छात्रों को 1 या 2 अंगुलियों के व्यायाम कराये गये। इसके बाद अभ्यास काल में जब भी छात्र थकान का अनुभव करते थे उन्हें अंगुलियों का व्यायाम कराया जाता था।

(ट) छात्रों की गति एवं शुद्धता का मूल्यांकन

दोनों समूहों के छात्रों के टंकन अभ्यास का मूल्यांकन करने के लिए अन्वेषक द्वारा निर्मित गति परीक्षणों का प्रयोग किया गया। प्रत्येक पाँच पाठों के बाद गति शुद्धता का परीक्षण किया जाता था। गति परीक्षण की अवधि 5 मिनट से 10 मिनट तक निर्धारित की गई। परीक्षण की अवधि गति के विकास के अनुसार रखी गई। जिसका विवरण निम्न प्रकार है :

परीक्षण	परीक्षण की अवधि
प्रथम	5 मिनट
द्वितीय	7 मिनट
तृतीय	10 मिनट
चतुर्थ (अ)	5 मिनट
चतुर्थ (ब)	5 मिनट

गति एवं शुद्धता परीक्षण पूर्णतः मनोवैज्ञानिक सिद्धान्तों पर बनाये गये। संक्षेप में गति परीक्षणों की विशेषताएँ निम्न प्रकार हैं :

1—दोनों ही समूहों के लिए एक ही परीक्षण दिया गया;

2—प्रत्येक इकाई परीक्षण में उन्हीं अक्षरों एवं संकेतों को सम्मिलित किया गया जिनका दोनों ही समूहों द्वारा नियंत्रण किया जा चुका था,

3—परीक्षणों में पूर्वाभ्यास तथा शुद्धता अभ्यास की समुचित व्यवस्था की गई,

4—परीक्षण के सम्बन्ध से छात्रों को स्पष्ट निर्देश दिये गये;

5—गति गणना के लिए परीक्षण की प्रत्येक पंक्ति में प्रहारों और उनकी संचयी की गणना अंकित की गई;

6—प्रत्येक परीक्षण की शब्दांश तीव्रता की गणना करके विषय सामग्री की कठिनता का स्तर भी ज्ञात किया गया; 2·02 से 2·2 तक के स्तर की शब्दांश तीव्रता की सामग्री छात्रों को परीक्षण के लिए दी गई;

7—गति की गणना के लिए मानक शब्दों की संख्या भी अंकित की गई;
(5 प्रहार=1 मानक शब्द)

8—छात्रों को गति एवं शुद्धता ज्ञात करने के स्पष्ट संकेत दिये गये;

9—गति एवं शुद्धता परीक्षण में पंक्ति की व्यवस्था इस प्रकार की गई कि दोनों ओर का उपान्त समान रहे, जिससे कि छात्र किसी पंक्ति में अशुद्धियों का पता लगा सके।

(4) **परीक्षण परिणामों का विवेचन**

परीक्षण परिणामों का अन्तिम विवरण निम्न प्रकार है :

क्रम संख्या	**परीक्षण संख्या**	**सप्ताह**	**माध्य**			
			नियन्त्रित समूह		**प्रयोगात्मक समूह**	
			प्रति मिनट कुल शब्द	**प्रति मिनट शुद्ध शब्द**	**प्रति मिनट कुल शब्द**	**प्रति मिनट शुद्ध शब्द**
(1)	प्रथम इकाई	प्रथम	19·92	17·00	16·00	14·00
(2)	द्वितीय इकाई	द्वितीय	21·62	19·00	14·92	12·85
(3)	तृतीय इकाई	तृतीय	20·00	18·15	15·23	13·15
(4)	चतुर्थ (अ)	चतुर्थ	24·08	21·08	18·38	16·69
(5)	चतुर्थ (ब)	चतुर्थ	23·46	20·30	17·15	15·30
		योग का माध्य	21·816	19·106	16·336	14·398

(1) समान बौद्धिक स्तर के दोनों समूहों को एक सी अभ्यास सामग्री, अध्यापन विधि, टंकन सुविधाएँ एवं परीक्षण विधियों का प्रयोग करने पर भी गति एवं शुद्धता के विकास में भिन्नता रही। प्रत्येक परीक्षण का माध्य, प्रति मिनट कुल टंकित शब्दों के आधार पर तथा प्रति मिनट टंकित शब्दों के आधार पर नियंत्रित समूह का श्रेष्ठ रहा।

(2) पाँचों परीक्षणों का माध्य निकालने पर ज्ञात होता है कि नियंत्रित समूह दोनों ही दृष्टिकोणों से श्रेष्ठ है—कुल शब्द प्रति मिनट तथा शुद्ध शब्द प्रति मिनट।

(3) तीसरे परीक्षण में नियंत्रित समूह की दूसरे परीक्षण की अपेक्षा कम विकसित हुई है; जिसका मुख्य कारण यह हो सकता है कि तीसरी इकाई में छात्रों को दाहिनी कल-बदल का प्रयोग करने में कुछ असुविधा रही। दूसरी ओर प्रयोगात्मक समूह की गति एवं शुद्धता दूसरे की अपेक्षा तीसरे परीक्षण में बढ़ी; जिसका कारण यह हो

सकता है कि इस समूह में दाहिनी कल-बदल का प्रयोग करने में सुविधा रही।

(4) प्रयोगात्मक समूह में प्रथम सप्ताह की अपेक्षा दूसरे सप्ताह में गति एवं शुद्धता कम रही। जिसका कारण यह हो सकता है कि इस सप्ताह बाँयी कल-बदल का प्रयोग कराया गया था। बाँयी कल-बदल तक अंगुली की पहुँच इस समूह के लिए नियंत्रित समूह की अपेक्षा कठिन पड़ती है।

निष्कषं :

दोनों ही समूहों को एक ओर की कल-बदल के प्रयोग करने में कठिनाई रहती है। किन्तु दोनों ओर की कल-बदलों का प्रयोग करने पर नियंत्रित समूह के परिणाम अधिक श्रेष्ठ रहे हैं।

	नियंत्रित	प्रयोगात्मक
प्रति मिनट कुल शब्द	21·816	16·336
प्रति मिनट शुद्ध शब्द	19·106	14·398

(5) दोनों ही समूहों में चौथे (अ) परीक्षण की अपेक्षा चौथे (ब) परीक्षण की गति कम रही। जिसका कारण यह था कि प्रथम परीक्षण की शब्दांश तीव्रता (2·02) द्वितीय परीक्षण की शब्दांश तीव्रता (2·2) से कम है।

नियंत्रित समूह की प्रयोगात्मक समूह से हर प्रकार तुलना करने पर यह निष्कर्ष निकलता है कि टंकन सीखने में नियंत्रित समूह के विद्यार्थी टंकन दक्षता विकसित करने में अधिक समर्थ हैं।

(5) परियोजना के व्यावहारिक प्रयोग

(1) विद्यालयों में छात्रों को इसी विधि से टंकन अध्ययन कराया जाए, इसके अन्तर्गत गृह आधार कुंजियों की व्यवस्था निम्न प्रकार होनी चाहिये —

(˙)	(`)	(क)	(f)
कनिष्ठा	अनामिका	मध्यमा	तर्जनी

————————बाँया हाथ————

(य)	(स)	(ास)	(र)
कनिष्ठा	अनामिका	मध्यमा	तर्जनी

————————दाहिना हाथ————

(2) विविध कुंजी प्रयोग विधि के द्वारा ही गृह आधार कुंजियों की यह व्यवस्था अधिक उपयोगी होगी।

(3) इस योजना को अपनाने पर छात्रों द्वारा स्वयं टंकन की अपेक्षा अध्यापक द्वारा टंकन-अध्यापन में सक्रिय सहयोग (प्रदर्शन, श्रुतलेख, सावधि अभ्यास आदि) देना चाहिए।

(4) टंकन के घण्टे का विभाजन विविध क्रियाओं के लिए (अंगुली व्यायाम पूर्वाभ्यास, प्रूफ रीडिंग, सावधि अभ्यास आदि) अवश्य होना चाहिए।

(5) कक्षा में छात्रों को उत्प्रेरित करने के लिए उनका आगामी लक्ष्य (गति अथवा शुद्धता) अवश्य निर्धारित करना चाहिए।

(6) प्रत्येक इकाई के पश्चात् छात्रों की दक्षता का परीक्षण सरल गद्यांश के रूप में अवश्य होना चाहिए। परीक्षण का समय 5 मिनट से 10 मिनट तक ही होना चाहिए।

(7) इस विधि द्वारा अध्यापन करने के लिए मनोवैज्ञानिक सिद्धान्तों पर आधारित पाठ्य-पुस्तकें भी अवश्य प्रकाशित कराई जानी चाहिए। इनका अभाव वाणिज्य शिक्षा जगत् में बहुत खटकता है।

(6) शोध कार्य की अन्य सम्भावनाएँ

वर्तमान परिस्थितियों में परियोजना को केवल कुंजी-पटल पूर्ण करने तक ही सीमित रखा गया था। अनुकूल परिस्थितियों में इसका प्रयोग उदग्र तथा क्षैतिज केन्द्र, सारिणी टंकन, पत्र टंकन तथा अन्य उत्पादन टंकन क्षेत्र में भी किया जा सकता है। साथ ही विविध शैक्षिक स्तर तथा आयु-समूह के छात्रों पर भी इसका प्रयोग किया जा सकता है।

ANNEXURE—1

पाठ—एक (गृह आधार कुंजियां)

प्र/स—1
उपान्त : 40
समय : 40 मिनट
अन्तर : दोहरा

गृह कुंजी अभ्यास

(तकनीक 10 मिनट और अभ्यास 15 मिनट)

(प्रत्येक पंक्ति को एक बार अध्यापक की सहायता से और दो मिनट तक स्वयं अभ्यास करो)

तर्जनी	हहह हहह हहह ााा ााा ााा हहह ााा हहह ााा	
मध्यमा	fff fff fff ससस ससस ससस fff ससस fff ससस	
अनामिका	ककक ककक ककक ययय ययय ययय ककक ययय ककक ययय	
कनिष्ठा	``` ``` ``` श्श्श श्श्श श्श्श ``` श्श्श ``` श्श्श	निष्क्रिय कुंजियों को
चारों अंगुलियाँ	हहह ााा fff ससस ककक ययय ``` श्श्श हहह ााा	दबाने के बाद एक स्थान छोड़ो।

शब्द अभ्यास

(10 मिनट)

(प्रत्येक पंक्ति का दो मिनट तक अभ्यास करो और प्रत्येक अभ्यास के बाद एक अतिरिक्त पंक्ति छोड़ो)

ो=पहले
ा और पिनर
` की मात्रा

ककक हहह कहक कहक हक ययय ससस यह श्श्श ााा शक शक
कसक कसक यह यह कह कह सह ``` ााा ोोो
कहा कहा हाय हाय काया काया साया साया याक याक यह
केस केस सेक सेक केक केक किस किस हिया हिया सिया सिया
कोस कोस शोक शोक होश होश सिया सिया हाशिया हाशिया

'श' टंकन करने के लिये 'ा' का भी प्रयोग करते हैं।
'f' की मात्रा पहले टंकन करते हैं।

शब्द समूह अभ्यास

(5 मिनट)

1—निम्न पंक्तियों को पाँच मिनट तक टंकन करो और हर अभ्यास के बाद एक अतिरिक्त पंक्ति छोड़ो।

2—शब्द समूहों को तिरछी रेखाओं के द्वारा अलग किया गया है। अभ्यास करते समय तिरछी रेखाओं को टंकन न करके उनके स्थान पर एक अधिक स्थान छोड़ो।

किस से कहिये/यह केक सेक/काया को कस/किसका सहायक/
यह केस किसका/किसको कहा/किस से कहा/शाह से कहा/
यह किस से कहा/साहस से कह/हाय हाय यह किसका साहस/
= =

हमेशा ध्यान रखो—

अंगुलियों को गृह आधार कुंजियों पर ही रखते हैं। बाँये हाथ की अंगुलियाँ क्रमशः (`) (क) (f) (ह) कुंजियों तथा दाहिने हाथ की अंगुलियाँ क्रमशः (ा) (स) (य) (श्) कुंजियों पर रखते हैं।

ANNEXURE—2

पाठ—एक (गृह आधार कुंजियाँ)

नि/स—1

उपान्त : 40
समय : 40 मिनट
अन्तर : दोहरा

गृह कुंजी अभ्यास

(प्रत्येक पंक्ति को एक बार अध्यापक की सहायता से और दो मिनट तक स्वयं अभ्यास करो)

(तकनीक 10 मिनट और अभ्यास 15 मिनट)

तर्जनी	fff fff fff ररर ररर ररर fff ररर fff ररर
मध्यमा	ककक ककक ककक ııı ııı ııı ककक ııı ककक ııı
अनामिका	``` ``` ``` ससस ससस ससस ``` ससस ``` ससस
कनिष्ठा	... ... ययय ययय ययय ... ययय ... ययय
चारों अंगुली	fff ररर ककक ııı ``` ससस ... ययय fff ररर

निष्क्रिय कुंजियों को दबाने के बाद एक स्थान छोड़िये ।

शब्द अभ्यास

(10 मिनट)

(प्रत्येक पंक्ति का दो मिनट तक अभ्यास करो और प्रत्येक अभ्यास के बाद एक अतिरिक्त पंक्ति छोड़ो)

रस सर सरक सरक सरस सरस कसर कसर ररक ररक कर कर
कार कार यार यार सार सार रास रास याक याक कारा कारा
रेस रेस सेर सेर सरेस सरेस सकेर सकेर कायर कायर सायर सायर
किस किस सिर सिर कोर कोर रोक रोक करो करो रंक रंक कंस
सिक सिक साँस साँस काँस काँस रस सरस यार कार रास रसिक

'ı'=पहले आ की मात्रा और बाद में ए की मात्रा

'f' पहले टंकन करते हैं ।

शब्द समूह अभ्यास

(5 मिनट)

1—निम्न पंक्तियों का 5 मिनट तक टंकन करो और हर अभ्यास के बाद एक अतिरिक्त पंक्ति छोड़ो ।

2—शब्द समूहों को तिरछी रेखाओं द्वारा अलग किया गया है । अभ्यास करते समय तिरछी रेखाओं को टंकन न करके उनके स्थान पर एक स्थान अधिक छोड़ो ।

राका रार कर/कर राका रार कर/ राका का कर/
साँस रोक/साँस रोक कर कर/सारा रस सकोरा से कर/
सारा सिरका का रस कर/काँस का रस सकोरा से कर/
सिसक सिसक कर रो/कार को रोको/काया को कस/
=============:========

हमेशा ध्यान रखो

अंगुलियों को गृह आधार कुंजियों पर ही रखते हैं। बाँये हाथ की अंगुलियाँ क्रमशः (ं)(े) (क) (f) कुंजियों पर तथा दाहिने हाथ की अंगुलियाँ क्रमशः (र)(ा)(स)(य) कुंजियों पर रहती हैं।

ANNEXURE—3

गति एवं शुद्धता परीक्षण

(प्रथम इकाई)

उपान्त : 40
समय : 40 मिनट
अन्तर : दोहरा

नियन्त्रित वर्ण :
˙/ˋ/क/ि/ह/ी/र/ा/स/य/श्/
./म/त/व///ग/ए/ण/द/
अन्य संभव वर्ण :
श/ध/ण ा/ ो/ऐ//

क—पूर्वाभ्यास (5 मिनट)

(निम्न पंक्तियों को दो मिनट तक स्वयं टंकन करो)

कारा राका सार रास हीरा राही गाय गया मात ताम वरण
सूत तूस एग गए शोर रोश धार धरा कंस संक कण्व से ऐसा

ख—शुद्धता अभ्यास (5 मिनट)

(प्रत्येक पंक्ति को एक बार अध्यापक की सहायता से और एक मिनट तक स्वयं टंकन करो। शुद्धता का विशेष ध्यान रखो)

रस सर सरस करकस कसक मगर गरम मरम मरहम सरगम
गिर गिरि गिरा सागर गागर गगरी वीर रावी वारि विरह
शेर सेर रेस रोश शोर शोक कवि-कीव काँव सका सवा सवक
रमक कमर रोमर कामर कामकर कायर सायक कायम कासिम
कसिस सिसक ममता ववा धधक ररक गगरी ससुर किक सरर

ग—गति एवं शुद्धता परीक्षण (5 मिनट)

सामान्य निर्देश :

1. परीक्षण के लिए नये कागज़ का प्रयोग कीजिये।
2. कागज़ के ऊपर दाहिनी ओर अपना नाम एवं दिनांक अवश्य लिखिये।
3. उपान्त इस प्रकार लगाइये कि कागज़ के मध्य 40 स्थान रहें।
4. पंक्तियों के मध्य दोहरा अन्तर रखिये।
5. इस परीक्षण के लिए 5 मिनट का समय निर्धारित है।

6. "प्रारम्भ" करने के लिए संकेत मिलने पर ही टंकन प्रारम्भ कीजिये और "समाप्त" का संकेत मिलने के पश्चात् टंकन न कीजिये ।
7. टंकन करते समय यदि आपके यन्त्र में कोई खराबी आ जाय तो कार्य बन्द करके शान्त बैठ जाइये ।
8. वाक्यों को अलग करने के लिए जिन तिरछी रेखाओं का प्रयोग किया गया है उन्हें टंकन न करके उनके स्थान पर एक अन्तर अधिक छोड़िये ।

	प्रहार	संचयी
कमरे में मत रहो/हरीश काम करके गया/यही काम करेगा	51	51
सवेरा हो गया होगा/हम काशी गये/राकेश सो रहा होगा	55	106
हरी का विश्वास मत करो/कोशिश करोगे तो काम होगा ही	55	161
वह शेर का शिकार कर रहा होगा/गिरधर धीरे धीरे गया	54	215
राधा यहीं सिसक सिसक कर रोयी/यही सागर गहरा होगा	50	265
राम से रावण मारा गया/गंगा की धार एकसी ही हो गयी	51	316
हरी तू ऐसा काम मत कर/हिसार शहर हरियाणा में होगा	52	368
कम करो	7	375

(शब्दांश तीव्रता 2·11 सरल)

मानक शब्द=75

गति कैसे ज्ञात करते हैं ?

पाँच प्रहारों (स्ट्रोक्स) का एक मानक शब्द गिना जाता है । कुल मानक शब्दों में निर्धारित समय का भाग देने से प्रति मिनट टंकन गति मालूम हो जाती है ।

×=×=×

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ANNEXURE—1

भाषा-प्रयोगशाला (प्रथम विभाग)

एक गाँव में एक आदमी रहता था । वह अंधा था । वह कई सालों से अंधा था । फिर भी वह गाँव भर में चलता-फिरता था । वह कुछ न कुछ काम भी करता था ।

एक रात को वह अंधा हाथ में एक घड़ा लेकर कहीं जा रहा था । उसके एक हाथ में एक घड़ा था और दूसरे हाथ में एक लालटेन थी । गाँव भर के रास्ते उसे मालूम थे । वह रोज उन पर आता-जाता था ।

अंधा लालटेन लेकर जा रहा है, उसे देखकर कुछ लोगों को अचरज हुआ । एक आदमी ने उससे पूछा, "क्यों बाबा, तुम तो अंधे हो, तुमको लालटेन क्यों चाहिए ?"

अंधे ने जवाब दिया, "मैं अंधा हूँ तो क्या हुआ ? मैं तो बराबर चलता ही हूँ । लेकिन दूसरे लोग आकर मुझसे टकरायेंगे तो क्या होगा ? मेरा घड़ा फूट जायगा । दुनियाँ में आँखों वाले लोग भी कभी-कभी आँखें बंद करके काम करते हैं । यह लालटेन ऐसे लोगों के लिए है ।"

उस आदमी ने अंधे का जवाब सुनकर कहा—"यह तो ठीक कह रहा है ।"

(शब्द संख्या 160)

अभ्यास

1. इस कहानी का शीर्षक है—
   (क) मूर्ख अंधा, (ख) आँखों वाला अंधा, (ग) लालटेन वाला अंधा, (घ) अंधे की कहानी ।
2. यहाँ का अंधा—
   (क) कई सालों से अंधा था (ख) आँखोंवाला अंधा था, (ग) जन्मांध (घ) अभी-अभी अंधा हुआ था ।
3. वह अंधा इसलिए लालटेन ले जा रहा था—
   (क) जिससे रास्ता साफ-साफ दिखाई पड़े (ख) जिससे शीघ्र चल सके, (ग) लोग उससे न टकरायें, (घ) घड़ा न फूट जाए ।
4. इस कहानी में फूट का अर्थ है—
   (क) टूट जाना, (ख) झगड़ना, (ग) प्रकट करना, (घ) फट जाना ।
5. लेखक इस कहानी द्वारा यह कहना चाहता है कि—
   (क) अंधे होशियार रहते हैं । (ख) आँखोंवाले भी कभी-कभी आँखें बंद करके काम करते हैं । (ग) रात में अंधों को लालटेन लेकर चलना है । (घ) अंधों के लिए लालटेन ही आँखों का काम करती है ।
6. इस कहनी में आँख बंद करके काम करने का अर्थ है—
   (क) आँख मूँद करके, (ख) मूर्खता से (ग) असावधानी से (घ) आसानी से ।
7. जाएगा शब्द में निहित धातु—
   (क) जाए, (ख) जाएगा, (ग) जा, (घ) जाँय, (च) जाएँ ।
8. जो शब्द पर्यायवाची नहीं उसे पहचानिये—
   (क) अचरज, (ख) अचंभा, (ग) विस्मय, (घ) आश्चर्य, (च) अचानक ।
9. जिस जोड़ी में विलोम शब्द ठीक नहीं बैठते उसे पहचानिए—
   (क) कुछ × बहुत, (ख) जवाब × सवाल, (ग) बंद × खोल (घ) आदमी × औरत ।
10. जिस शब्द में काल की समानता नहीं है उसे पहचानिए ।
    (क) टकराएँगे, (ख) टकराएँगी (ग) टकराएगा, (घ) टकरावें, (च) टकराऊँगा ।

ANNEXURE—2

समुद्री मृत जीवजन्तुओं के शरीर से औषधियाँ

न्यूयार्क मत्स्यशाला की प्रयोगशाला के डा० जैकोबस्का का कहना है कि मृत जीवों के शरीर के गलने पर आसपास का समुद्री जल दूषित हो जाता है। लेकिन स्पंजों के आसपास मृत जीवों के शरीरों के चारों ओर का जल स्वच्छ बना रहता है। उन्होंने सोचा कि शायद स्पंजों से अथवा उनके अन्दर मौजूद सूक्ष्म जीवाणुओं से ऐसा कोई पदार्थ निकलता रहता है जिससे जल को दूषित करने वाले कीटाणु पनपने नहीं पाते। यदि यह अनुमान ठीक हो तो उनसे अत्यन्त प्रभावशाली रोगाणुनाशक औषधि तैयार हो सकती है।

आज समुद्र में पाये जाने वाले तत्वों से निर्मित औषधियों का बहुत महत्व है। भूमि स्थित स्रोतों से विकसित औषधियाँ कई प्रकार के संक्रामक रोगाणुओं और फफूंदियों पर नियन्त्रण प्राप्त करने में अधिक प्रभावशाली सिद्ध नहीं हुई हैं। इसके अलावा कई प्रकार के घातक रोगाणुओं की ऐसी नई किस्में हो गई हैं जो पेनिसिलिन जैसी चमत्कारी औषधियों का प्रभाव व्यर्थ कर देती हैं।

एक ऐसी विषाणुनाशक औषधि, जिसकी आज बहुत आवश्यकता है, का विकास 'नेशनल इन्स्टिट्यूट ऑफ हैल्थ', बैथेस्डा (मैरिलैंड) के डा० सी० पी० ली कर रहे हैं। पाओलिन—2 नामक यह औषधि समुद्री-जीवों, जैसे सीप और घोघों के शरीर में प्राप्त द्रवों के संयोग से तैयार की जा रही है।

मानस विकार की शक्तिशाली दवाओं में से एक अज्ञात दवा भी समुद्र से प्राप्त हुई है। दक्षिणी सागर के मूल निवासियों को यह बात चिरकाल से ज्ञात है कि कुछ मछलियों का मांस खाने से आत्मविस्मृति हो जाती है। इन समाचारों से चकित होकर कैलिफोर्निया के 'वर्ल्ड लाइफ रिसर्च इन्स्टीट्यूट' के वैज्ञानिकों ने कुछ ऐसी मछलियाँ एकत्र कीं, जिनके विषय में आत्मविस्मृति उत्पन्न करने का गुण होने की अफवाह थी। उनमें से एक मछली से—जिसका नाम ही 'स्वप्न मत्स्य' रख दिया गया है—उन्होंने मानसिक औषधि की संभावना वाले अंश को पृथक कर दिया।

समुद्री जीवों और पौधों से उत्पन्न विष भावी औषधियों का अत्यन्त सम्भावना पूर्ण स्रोत है। समुद्री जीवों से अधिकतम प्रभावकारी विष उत्पन्न होता है। पफर मछली से निकलने वाला विष सबसे विषैली गैस से 3 हजार गुना तेज होता है। किंतु समुचित रूप से नियंत्रित और शोषित होने पर ये विष अत्यन्त उपयोगी औषधियों के साधन बन सकते हैं।

टेट्रोडोटोसिन जितनी पीड़ाहर औषधि है, उतनी बिरले ही कोई होगी। यह मछली के विष से तैयार होती है। जापान में इसका प्रयोग कैंसर के आखिरी चरण में होता है। इसका प्रयोग सिरदर्द और मांसपेशी की पीड़ा को दूर करने के लिए भी होता है।

इस समय समुद्री जीवों के चिकित्सा सम्बन्धी गुणों की खोज करने वाले वैज्ञानिक समुद्री जीवों के मांस में पाये जाने वाले रसायनों का अध्ययन करने में संलग्न हैं। किंतु समुद्री जीवों के एक अन्य पहलू—इसके भौतिक गुण—के सम्बन्ध में खोज करने के लिए उचित समय, धन और श्रम का अभाव है। फिर भी कई समुद्री जीवों की भद्दी क्षमताओं में शायद जीवन की आधारभूत प्रक्रियाओं के रहस्य निहित हो सकते हैं।

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आपने इस गद्यांश को कहाँ तक समझा है ?

1. लेखक क्या कहना चाहते हैं ?

1. डा० जैकोबस्का का कथन है कि—
   (क) स्पंजों के आसपास मृत जीवों के शरीरों के चारों ओर का जल दूषित हो जाता है ।
   (ख) स्पंजों के आसपास मृत जीवों के शरीरों के चारों ओर का जल स्वच्छ हो जाता है ।
   (ग) स्पंजों में कीटाणु पनपते हैं ।
   (घ) स्पंजों में रोगाणु नाशक औषध है ।

2. विषाणु नाशक औषधि 'पाओलिन—2' का निर्माण किसने किया ?
   (क) डा० जैकोबस्का (ख) डा० सी० पी० ली (ग) दक्षिण सागर के एक मूल निवासी (घ) कैलिफोर्निया के एक वैज्ञानिक ।

3. किस मछली को खाने से आत्मविस्मृति हो जाती है ?
   (क) पफर मछली (ख) स्वप्न-मत्स्य (ग) हैग-फिश (घ) स्टार फिश ।

4. 'पाओलिन—2' का निर्माण ।
   (क) पैनिसिलिन के साथ सीप और घोघों को मिलाकर करते हैं । (ख) सीप और घोघों के शरीर में प्राप्त द्रवों के संयोग से करते हैं । (ग) 'स्वप्न मत्स्य' से प्राप्त द्रव से करते हैं । (घ) स्पंजों से मिलने वाले रोगाणु नाशक औषधि से करते हैं ।

5. पफर मछली से निकलने वाला विष
   (क) नाग के विष से सौ गुना तेज है । (ख) विषैली गैस से तीन हजार गुना तेज है । (ग) सबसे विषैली गैस से तीन हजार गुना तेज है । (घ) लोगों को मारने में असमर्थ है ।

6. 'टेट्रोडोटोसिन' का प्रयोग किस रोग के लिए करते हैं ?
   (क) टी० बी० (ख) अपेंडिसाइटिस (ग) कैंसर (घ) कुष्ठ ।

. लेखक का कथन है कि समुद्री जीवों और पौधों से उत्पन्न (क) जीवाणु से औषध तैयार करते हैं (ख) विष से औषध तैयार करते हैं (ग) औषध से अमर बन सकते हैं (घ) रोगाणु कीटाणुओं से सारी दुनियाँ समाप्त हो जाएगी ।

8. अधिक पीड़ाहर औषध यह है—
   (क) पेनिसिलिन (ख) पाओलिन (ग) पाओलिन—2 (घ) टेट्रोडोटोसिन ।

9. संक्रामक रोग को पहचानिये—
   (क) टाइफाइड (ख) निमोनिया (ग) कॉलरा (घ) खाँसी ।

10. 'वर्ल्ड लाइफ रिसर्च इन्स्टिट्यूट' कहाँ स्थित है ?
    (क) मैरिलैंड (ख) न्यूयार्क (ग) दिहेक (घ) कैलिफोर्निया ।

2. शब्द ज्ञान बढ़ाइये

1. 'क' वर्ग में कुछ शब्द विशेष एवं 'ख' वर्ग में उदाहरण अदल-बदल कर दिये गए हैं । उनको मिलाइये ।

'क' वर्ग	'ख' वर्ग
11. उपसर्गयुक्त शब्द	(क) मत्स्यशाला
12. प्रत्यययुक्त शब्द	(ख) नेशनल्
13. हलंत शब्द	(ग) प्रक्रिया
14. विसर्ग युक्त शब्द	(घ) स्वप्न
15. संयोग शब्द	(च) अतः

2 'क' वर्ग में सन्धि का नाम और 'ख' वर्ग में उदाहरण प्रस्तुत है । दोनों को मिलाइये ।

'क' वर्ग	'ख' वर्ग
16. विसर्ग संधि	(क) जीवाणु
17. वृद्धि संधि	(ख) संयोग
18. यण सन्धि	(ग) एकैक
19. व्यंजन संधि	(घ) निर्मल
20. दीर्घ संधि	(च) अत्यन्त

3. निम्नलिखित शब्दों का स्वर और व्यंजन अलग कीजिये । जैसे : है=ह+ऐ

21. हो 22. मैं 23. भी 24. से 25. या

4. **विरोधार्थी शब्द वे हैं जो अर्थ में विरोध प्रकट करते हों । जैसे : मृत × जीवित**

निम्नलिखित शब्दों का विरोधार्थी शब्द लिखिये—

26. प्राप्त 27. दक्षिण 28. उचित 29. भद्दा 30. अज्ञात

5. किसी शब्द विशेष के लिए प्रयुक्त अन्य समान अर्थ देने वाले शब्दों को पर्यायवाची शब्द कहते हैं । जैसे : सूर्य = रवि, दिनकर, दिनेश, भास्कर सूरज ।

निम्नलिखित शब्दों में जो पर्यायवाची शब्द नहीं हैं उसे पहचानिए—

31. पर, किंतु, लेकिन, मगर, तो ।
32. और, व, वरन्, तथा एवं ।
33. पश्चात्. उपरांत, तदुपरांत, बाद, अतः ।
34. किस्म, प्रकार, वगैरह, तरह, वगैर ।
35. समुद्र, दरिया, सागर, जलनिधि, रत्नाकर ।

6. **निम्नलिखित शब्द समूहों में जो अशुद्ध शब्द नहीं हैं उन्हें पहचानिये—**

36. नाषक, नाशक, नाशस, नासक ।
37. विशेष, विषेश, विशेस, विषेस, विसेष ।
38. स्रोत, स्त्रोत, सरोत, सोर्त ।
39. प्रभावषाली, प्रभावशाली, प्रभावसाली, प्रबावसाली, प्रबावशाली ।
40. आत्मविस्मृति, आत्मविस्मृती, आत्मवीस्मृति, आतमविस्मृति, आत्माविस्मृति ।

7. **'क' वर्ग में कुछ चिह्न और 'ख' वर्ग में उनके नाम लिखे गए हैं । दोनों को मिलाइए ।**

'क' वर्ग	**'ख' वर्ग**
41. ?	(क) पूर्ण विराम
42. ,, ,,	(ख) प्रश्नसूचक
43. ( )	(ग) समासचिह्न
44. —	(घ) कोष्ठक
45. ।	(च) उद्धरणचिह्न

8. **निम्नलिखित तत्सम शब्दों को तद्भव रूप में परिवर्तित कीजिए—**

46. अद्य 47. समुद्र 48. मच्छ 49. नष्ट 50. स्वप्न

उत्तर तालिका

1. ख 2. ख 3. ख 4. ख 5. ख 6. ग 7. ख 8. घ 9. ग 10. घ 11. ग 12. क 13. ख 14. च 15. घ 16. घ 17. ग 18. च 19. ख 20. क 21. ह् + ओ 22. म् + ऐं 23. भ + ई 24. स + ए 25. य + आ 26. अप्राप्त 27. उत्तर 28. अनुचित 29. सुन्दर 30. ज्ञात 31. तो 32. वरन 33. अत: 34. वगैर 35. दरिया 36. नाशक 37. विशेष 38. स्रोत 39. प्रभावशाली 40. आत्मविस्मृति 41. ख 42. च 43. घ॑ 44. ग 45. क 46. आज 47. सागर 48. मछली 49. नाश 50. सपना ।

नीति बोधक

रात का समय था। चारों ओर अँधेरा था। पानी भी जोरों से बरस रहा था। एक यात्री एक धर्मशाला में पहुँचा। उसका सारा शरीर भीग गया था। उसने देखा, धर्मशाला का दरवाजा बंद है। उसने चौकीदार के लिए जोर से आवाज दी। कोई जवाब नहीं मिला। आखिर जोर से दरवाजा खटखटाया। चौकीदार ने अन्दर से पूछा—"कौन है?"

यात्री ने कहा—"मुझे यहाँ रात को ठहरना है। ज़रा दरवाजा खोलो।"

चौकीदार ने जवाब दिया—"चाभी खो गयी है। चाँदी से ही दरवाजा खुल सकता है।"

यात्री समझ गया कि चौकीदार कुछ पैसा चाहता है। उसने एक रुपया दरवाजे के नीचे से दे दिया। दरवाजा खुला और यात्री अन्दर गया। यात्री ने उस चौकीदार को पाठ सिखाना चाहा। इसलिए यात्री ने चौकीदार से कहा—"भाई, जरा मेरा सामान तो उठा लाओ।"

चौकीदार बाहर गया। अब यात्री ने झट दरवाजा बंद कर दिया। चौकीदार ने देखा कि दरवाजा बंद हो गया है। बाहर जोर-जोर से पानी बरस रहा था। वह चिल्लाकर आवाज देने लगा। यात्री ने कहा कि चाभी खो गयी है, चाँदी से ही दरवाजा खुल सकता है।

बेचारा चौकीदार क्या करता? उसने यात्री का दिया रुपया फिर दरवाजे के नीचे से दे दिया। दरवाजा खुल गया।

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अभ्यास

1. इस कहानी का शीर्षक यह है—
(क) चौकीदार (ख) बदला (ग) यात्री की कहानी (घ) चौकीदार और यात्री।

2. इस कहानी द्वारा लेखक हमें यह बताना चाहते हैं कि;
(क) रिश्वत लेना बुरा है (ख) यात्रियों को आश्रय देना है।
(ग) चौकीदार चालाक है (घ) चौकीदार को पैसा देना है।

3. चौकीदार दरवाजे को इसलिए बंद कर चुका था कि;
(क) जोर-जोर से पानी बरसता था (ख) चोर डाकू से डरता था (ग) पैसा प्राप्त करना चाहता था (घ) यात्री से नफरत करता था।

4. यात्री ने धर्मशाला के दरवाजे को बंद कर दिया; क्योंकि
(क) चौकीदार से पैसा वापस लेना चाहता था।
(ख) चौकीदार को पानी से भिगोना चाहता था।
(ग) चौकीदार को पाठ सिखाना चाहता था।
(घ) चौकीदार से हँसी-मजाक करना चाहता था।

5. इस कहानी में आवाज का अर्थ है।
(क) पुकारना (ख) ध्वनि (ग) शब्द (घ) खटखटाना।

6. जो पर्यायवाची शब्द नहीं है उसे बताइए—
(क) यात्री (ख) पथिक (ग) राहगीर (घ) यात्रा।

7. जो शब्द स्त्रीलिंगवाची नहीं है उसे पहचानिए
(क) चाभी (ख) कुँजी (ग) ताला (घ) ताली।
8. खोलो, खुल, खुला, खुली, खुले आदि शब्दों की मूल-धातु—
(क) खोल (ख) खुल (ग) खुला (घ) खेल।
9. उल्टे अर्थवाले शब्दों की जोड़ी में जो शब्द ठीक नहीं बैठता उसे पहचानिए—
(क) खोल × बंद (ख) खोना × पाना (ग) उठ × बैठ (घ) नीचे × सामने
10. जिस शब्द में प्रत्यय ठीक नहीं है, उसे पहचानिए—
(क) दूकानदार (ख) खरीददार (ग) चौकीदार (घ) यात्रीदार।

घटना प्रधान एवं ज्ञानवर्धक

सन् 1925 की बात है। कानपुर में कांग्रेस का जलसा हो रहा था। जलसे की सभानेत्री एक महिला थी। उन्होंने अपने भाषण में कहा—मैं स्त्री हूँ। मैं चाहती हूँ मेरे घर में मेरा राज हो। भारतमाता भी चाहती है कि वह अपने देश की रानी हो। मैं भारतमाता की पुत्री हूँ। भारत से विदेशी शासकों को निकालना मेरा फर्ज है; मेरे ही नहीं मेरे देश के सभी भाई-बहनों का फर्ज़ है। यह गर्जन सुनकर सब दंग रह गये। विदेशी शासक भी एक स्त्री का साहस देखकर अचंभे में आ गये।

आप जानते हैं, यह साहसी महिला कौन थी? यह थीं सरोजिनी देवी। सरोजिनी पढ़ने-लिखने में बड़ी तेज थी। ग्यारह साल की उम्र में ही वह अंग्रेजी में कविता करने लगी। बारह साल की उम्र में वह मेट्रिक पास हुई। उसके बाद उसकी पढ़ाई विलायत में हुई।

जब देश में आज़ादी की लड़ाई शुरू हुई तो उनका मन उसमें लग गया। वे बापूजी के साथ आज़ादी की लड़ाई में शामिल हो गयीं। तब से बराबर गांधीजी के साथ रहीं। उनको कई बार जेल जाना पड़ा और तरह-तरह के कष्ट सहने पड़े। लेकिन उन्होंने ज़रा भी इनकी परवाह नहीं की।

भारत के स्वतंत्र होने के बाद सरोजिनी देवी उत्तर प्रदेश की गवर्नर बनीं और मरते समय तक इसी पद पर थीं। भारत की नामी महिलाओं में सरोजिनी देवी का ऊँचा स्थान है। अंग्रेजी विद्वान भी उनकी कविताओं की तारीफ़ करते थे।

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अभ्यास

1. सन् 1925 में कांग्रेस का जलसा यहाँ हुआ था।
(क) कानपुर में (ख) विलायत में (ग) बंगाल में (घ) उत्तर प्रदेश में।
2. इस कहानी का शीर्षक यह है—
(क) सरोजिनी देवी का भाषण (ख) साहसी महिला सरोजिनी देवी (ग) कांग्रेस जलसा (घ) आज़ादी की लड़ाई।
3. "मेरे घर में मेरा राज हो"—यहाँ राज का अर्थ
(क) राज्य (ख) अधिकार (ग) राजा (घ) राय।

4. कांग्रेस के जलसे में सरोजिनी देवी...थीं ।
(क) अभिनेत्री (ख) सदस्या (ग) सभानेत्री (घ) साहसी-महिला ।

5. जो पर्यायवाची शब्द नहीं है उसे बताइए ।
(क) अचंभा (ख) आश्चर्य (ग) दंग (घ) तंग ।

6. ···साल की उम्र में सरोजिनी मेट्रिक पास हुईं ।
(क) ग्यारह (ख) बारह (ग) चौदह (घ) तेरह ।

7. जब देश में आज़ादी की लड़ाई शुरू हुई तो उनका मन उसमें लग गया । यहाँ 'लग' शब्द का अर्थ है—
(क) छूट (ख) टक्कर (ग) लद (घ) प्रेम ।

8. भारत के स्वतंत्र होने के बाद सरोजिनी देवी उत्तर प्रदेश की...बनीं ।
(क) नामी महिला (ख) सभानेत्री (ग) रानी (घ) गवर्नर ।

9. जो पर्यायवाची शब्द नहीं है, उसे बताइए
(क) महिला (ख) स्त्री (ग) नारी (घ) रानी ।

10 जो पर्यायवाची शब्द नहीं है, उसे पहचानिए—
(क) बराबर (ख) निरंतर (ग) अकसर (घ) लगातार ।

देश एवं जन जीवन

भारत के आदिवासियों में तीसरी बड़ी जाति है भीलों की । ये लोग प्राय: राजस्थान, राजपीपला और खानदेश में रहते हैं । भील नाटे कद के, चौड़ी नाक वाले और श्याम वर्ण के होते हैं । ये प्राचीन काल से ही शिकार पर निर्भर हैं । स्वभाव से सरल और ईमानदार होते हैं । भीलों की अपनी एक अलग भाषा है जो राजस्थानी, खानदेशी, गुजराती और मराठी का विचित्र मिश्रण है ।

वे जंगलों में रहते थे, इसलिए मकानों को हिंसक पशुओं से बचाने के लिये छुपा हुआ रखते थे । इस दृष्टि से उनके मकान जमीन से तीन फुट की ऊँचाई पर पत्थर-मिट्टी की नींव रखकर बनाये जाते थे । मकान में कोई भी खिड़की नहीं रखी जाती । द्वार भी एक ही ओर नीचा बनाया जाता था ।

इनकी सामाजिक व्यवस्था भी एक मुखिया द्वारा नियन्त्रित होती है । नियमों का इन्हें कड़ाई से पालन करना पड़ता है । ग्राम के मुखिया के सामाजिक अधिकार काफी होते हैं । परिवार में पिता बड़ा माना जाता है । पिता की मृत्यु के पश्चात सबसे बड़े भाई को बैल और एक रुपया अधिक मिलता है, बाकी सबको बराबर-बराबर सम्पत्ति बँट जाती है । माँ जीवित रहती है तो सारी सम्पत्ति पर उसका ही अधिकार होता है ।

अभ्यास

1. इस गद्यांश का शीर्षक
(क) आदिवासी भील (ख) जंगली जातियाँ (ग) राजस्थानी (घ) भील ।

2. भील — में रहते हैं ।
(क) भारत (ख) राजस्थान और बिहार (ग) राजस्थान और खानदेश (घ) खानदेश और बिहार ।

3. भील नाटे कद के, चौड़ी नाक वाले—होते हैं ।
(क) काले वर्ण (ख) गोरे वर्ण (ग) हल्दी रंग (घ) श्याम वर्ण ।

1. भीलों की अपनी एक अलग भाषा है जो
   (क) चार भाषाओं का विचित्र मिश्रण है ।
   (ख) तीन भाषाओं का मिश्रण है ।
   (ग) चार भाषाओं और हिन्दी का मिश्रण है ।
   (घ) किसी भी भाषा का मिश्रण नहीं है ।

5. भीलों के मकानों में
   (क) खिड़की नहीं होती थी ।
   (ख) द्वार नहीं होता था ।
   (ग) एक खिड़की, एक द्वार होता था ।
   (घ) द्वार नहीं, चार खिड़कियाँ होती थीं ।

6. परिवार में
   (क) बड़ा भाई ही बड़ा माना जाता था ।
   (ख) पिता ही बड़ा माना जाता था ।
   (ग) माता ही बड़ी मानी जाती थी ।
   (घ) मुखिया ही बड़ा माना जाता था ।

7. पिता के मरने पर सारी सम्पत्ति
   (क) बड़े भाई को ही मिलती थी ।
   (ख) बड़ी बहन को मिलती थी ।
   (ग) छोटे भाई को मिलती थी ।
   (घ) माता को ही मिलती थी ।

8. भीलों के मकान जमीन से तीन फुट ऊँचाई पर पत्थर-मिट्टी की नींव रखकर इसलिए बनाये जाते थे कि
   (क) ठंडक भीतर न आवे ।
   (ख) शत्रु सीधे हमला न कर पावें ।
   (ग) पानी के बरसने पर पानी अन्दर न घुस पड़ें ।
   (घ) हिंस्र पशु अन्दर न घुस पड़ें ।

9. जो शब्द स्त्रीलिंग नहीं हैं उसे पहचानिये
   (क) खिड़की (ख) नाक (ग) मकान (घ) सम्पत्ति ।

10. जो संधि शब्द है उसे पहचानिये
   (क) पश्चात (ख) मिश्रण (ग) इत्यादि (घ) हिंस्र

कृषि विज्ञान

सोयाबीन का उत्पादन आरम्भ में केवल सुदूरपूर्व के देशों में मुख्यतः चीन और मंचूरिया में ही होता था । बाद में उसके खाद्य-सम्बन्धी महत्व का पता लगने पर विश्व में हर कहीं फैला । सोयाबीन में सब तरह के विटामिन, खनिज, लवण और दूसरे खाद्य-उपयोगी तत्व बहुतायत से पाये जाते हैं, लेकिन उसकी महत्ता का आधार है—उसमें निहित प्रोटीन तत्व । यह प्रोटीन जहाँ गुण में मांस, दूध और अण्डे जैसा ही श्रेष्ठ है वहाँ मात्रा में मांस से दुगना अण्डे से तिगुना और दूध से ग्यारह गुना अधिक होता है । अतः इसे दूध का पौधा भी कहते हैं ।

मूत्र के रोगियों के लिये यह बहुत लाभप्रद खाद्य वस्तु है । कृश शरीर वाले इसके निरन्तर उपयोग से चर्बी भी प्राप्त करते हैं । साधारणतः सोयाबीन का दैनिक उपयोग दूध और दही के रूप में ही अधिक होता है । खर्च तो आधा सेर पर एक आने से भी कम ।

सोयाबीन का आटा सर्वाधिक महत्वपूर्ण है । इससे रोटी, केक, बिस्कुट और दूसरी खाने की चीजें बनायी जाती हैं । दूसरे महायुद्ध के समय सैनिकों ने सोयाबीन की ऐसी गोलियाँ बनायीं जो खाने में बहुत स्वादिष्ट, हलकी और पाचक होती थीं—पौष्टिक इतनी कि दो-तीन गोलियाँ एक सैनिक के पूरे दिन के भोजन के लिए पर्याप्त होती थीं ।

सोयाबीन से स्याही, साबुन, नकली ऊन, रबड़, प्लास्टिक, पेंसिल, वारनिश, क्रीम, ग्लिसरीन और

चमड़े जैसी व्यावसायिक महत्व की दो हजार से अधिक वस्तुएँ बनायी जाती हैं। इसका उत्पादन सरल है। कपास या जुआर उगाने वाली, साधारण जमीन इसके लिए अच्छी रहती है। बहुत कम देखभाल की जरूरत होती है और पकने के लिए समय भी केवल तीन ही महीने लगते हैं।

शब्द संख्या :: 258

अभ्यास

1. इस गद्यांश का शीर्षक
   (क) सोयाबीन (ख) दूध का पौधा सोयाबीन
   (ग) जीवन में सोयाबीन का स्थान
   (घ) विदेशी पौधा सोयाबीन।
2. इसे लिखने का, लेखक का मुख्य उद्देश्य
   (क) सोयाबीन का गुण-गान करना है।
   (ख) जीवन में सोयाबीन का स्थान दिखाना है।
   (ग) सोयाबीन का परिचय कराना है।
   (घ) कृषि विज्ञानियों को आकृष्ट करना है।
3. सोयाबीन पहले-पहल यहाँ पैदा होता था।
   (क) चीन और जापान (ख) जापान और मलाया (ग) जापान और मंचूरिया (घ) चीन और मंचूरिया।
4. सोयाबीन में ये तत्व पाये जाते हैं :
   (क) प्रोटीन, विटामिन एवं लवण (ख) खनिज और लवण (ग) प्रोटीन और स्टार्च (घ) स्टार्च और कार्बोहाइड्रेट।
5. साधारणतः सोयाबीन
   (क) मूत्र रोगियों के लिए अधिक उपयोगी है।
   (ख) सबके लिए दूध और दही के रूप में इस्तेमाल किया जाता है।
   (ग) उपयोगी ही नहीं।
   (घ) दवा के रूप में इस्तेमाल किया जाता है।
6. सोयाबीन से व्यवसायिक महत्व की
   (क) दो हजार वस्तुएँ बनायी जा सकती हैं।
   (ख) पाँच हजार वस्तुएँ बनायी जा सकती हैं।
   (ग) पाँच ही वस्तुएँ बनती हैं।
   (ध) कोई भी वस्तु नहीं बनती।
7. सोयाबीन की फसल वर्ष में
   (क) तीन बार काट सकते हैं।
   (ख) दो बार काट सकते हैं।
   (ग) चार बार काट सकते हैं।
   (घ) एक बार काट सकते हैं।
8. दूसरे युद्ध में सोयाबीन से
   (क) अणु बम तैयार किए गए।
   (ख) दवा तैयार की गयी।
   (ग) गोलियाँ तैयार की गयीं।
   (घ) भोजन की गोलियाँ तैयार की गयीं।
9. जो दूध से नहीं बनने वाली चीज है, उसे अलग कीजिए।
   (क) दूध (ख) दही (ग) मक्खन (घ) घी
10. जो शब्द पर्यायवाची नहीं उसे बताइए
    (क) ज्यादा (ख) अधिक (ग) खर्च
    (घ) बहुत।

ज्योतिशास्त्र

जिस तरह पृथ्वी पर रेलवे स्टेशन, बन्दरगाह, बस स्टैण्ड हैं। उसी तरह अंतरिक्ष यात्रिकों के लिए अंतरिक्ष स्टेशन बनाने की योजना आजकल हो रही है। योजनाओं के अनुसार आकाशस्थ स्टेशन पृथ्वी से 1000 मील ऊपर होगा। वहाँ गुरुत्वाकर्षण कम होता है। इस प्रकार 1000 मील पर 16000 मील प्रति घण्टे की चाल से किसी कक्ष में आकाशस्थ स्टेशन उसी तरह स्थायी रूप से घूमता रहेगा जैसे हमारा चन्द्रमा पृथ्वी के चारों ओर घूमता है। इतनी दूरी या चाल पर गुरुत्व और सेण्ट्रीफ्यूगल बल के दो परस्पर विरोधी दल पूर्ण संतुलन बनाए रखेंगे।

अंतरिक्ष स्टेशन बनाने के लिए तीन मंजिल वाले राकेट छोड़ने की योजना है। उनमें मनुष्य और सामान रखकर उन्हें एक-एक करके छोड़ा जाएगा। सामान जमा हो जाने पर अंतरिक्ष वस्त्रों से सुसज्जित लोग अंतरिक्ष स्टेशन बना देंगे। राकेट पृथ्वी पर लौट आएँगे जहाँ उन्हें फिर भर दिया जाएगा और वे फिर लौट जायेंगे।

अंतरिक्ष स्टेशन हवा-बन्द होना चाहिए, जिससे रहने वाले लोगों के लिए साँस लेने योग्य वायुमण्डल बना रह सके। 1000 मील पर हवा प्रायः बिलकुल नहीं है। यह सूर्य की गर्मी और आकाश की सर्दी से भी सुरक्षित होना चाहिए। इसकी रक्षा के लिए वायुमण्डल न होने के कारण सूर्य इसके प्रकाशित हिस्से को सैकड़ों अंश तक गर्म कर देगा। अप्रकाशित भाग पर ताप परम शून्य (ऐब्सोल्यूट जीरो) के निकट या लगभग 459 डिग्री फारेनहाईट होगा।

वर्तमान योजना के अनुसार अंतरिक्ष स्टेशन पुए की शकल का होगा। यह थोड़ा गुरुत्वाकर्षणीय प्रभाव पैदा करने के लिए चक्र की तरह धीरे-धीरे परिक्रमा करेगा।

शब्द संख्या :: 232

अभ्यास

1. इस गद्यांश का शीर्षक है
   (क) गुरुत्वाकर्षण (ख) अंतरिक्ष स्टेशन (ग) कृत्रिम स्टेशन (घ) उपग्रह।
2. लेखक का कथन है कि कुछ ही दिनों में वैज्ञानिक
   (क) चन्द्र तक पहुँचेंगे (ख) अंतरिक्ष स्टेशन का निर्माण करेंगे (ग) भू-प्रदक्षिण करेंगे (घ) उपग्रह छोड़ेंगे।
3. अंतरिक्ष स्टेशन इतनी ऊँचाई पर निर्माण करेंगे
   (क) 1000 फुट ऊपर (ख) 1000 मील ऊपर (ग) 16000 मील ऊपर (घ) 16000 फुट ऊपर।
4. यह अंतरिक्ष स्टेशन आकाश में किसी एक
   (क) जगह पर लटकता रहेगा।
   (ख) कक्ष में हमेशा चलता रहेगा।
   (ग) उसी जगह पर अपने-आप चक्कर काटता रहेगा।
   (घ) ग्रह पर होगा।
5. अंतरिक्ष स्टेशन हवा-बन्द होना चाहिए क्योंकि वहाँ
   (क) हवा ही नहीं (ख) हवा जोरों से बहती है (ग) वहाँ केवल कार्बन डाइआक्साइड है (घ) दूसरे ग्रहों से टकराने की संभावना है।
6. जो पर्यायवाची शब्द नहीं उसे बताइये
   (क) आकाश (ख) अंतरिक्ष (ग) आसमान (घ) अनल।

7. जिसमें विरोधार्थी शब्द ठीक नहीं उसे बताइए
(क) आजकल × पुराने जमाने (ख) कम × ज्यादा (ग) सुरक्षित × अरक्षित (घ) स्थायी × चिरस्थायी ।

8. वायुमण्डल रहित होने से अंतरिक्ष स्टेशन में
(क) गर्मी अधिक और सर्दी कम होगी ।
(ख) सर्दी अधिक और गर्मी कम होगी ।
(ग) सर्दी-गर्मी दोनों कम होगी ।
(घ) सर्दी-गर्मी दोनों अधिक होगी ।

9. अंतरिक्ष स्टेशन का आकार
(क) पुए की शकल का होगा ।
(ख) एरोड्राम का आकार होगा ।
(ग) रेलवे स्टेशन का आकार होगा ।
(घ) चन्द्रमा का आकार होगा ।

10. अप्रकाशित शब्द—से बना है
(क) उपसर्ग (ख) विसर्ग (ग) प्रत्यय (घ) समास ।

भारत के त्यौहार

अंग्रेज डेढ़ सौ बरसों तक हम पर राज करते रहे । हम अंग्रेजों के राज में आजादी के लिए तरसते थे । उन दिनों भारतमाता की जय पुकारना एक बड़ा अपराध था । आजादी की पुकार करने वालों को जेलों में ठूँस दिया जाता था । अपना हक माँगने वालों को मौत की सजा दी जाती थी ।

फिर भी हम घबराए नहीं । हमने विदेशी सत्ता से लड़ने की ठानी । अंग्रेजों के पास तोपें थीं । हमारे पास तप था । अंग्रेजों के पास संगीनें थीं; हमारे पास सच था । अंग्रेजों के पास सेना थी; हमारे पास शान्ति थी । हमने एक भी हथियार नहीं उठाया । आखिर सच की जीत हुई । हमारी विजय हुई । 15 अगस्त 1947 को हम आजाद हुए । उस दिन हमारे बंधन कटे । उस दिन हमारे प्रधान मन्त्री ने दिल्ली के लाल किले पर तिरंगा झण्डा फहराया था ।

अब हम आजाद हैं । उस दिन से हम पन्द्रह अगस्त का दिन हर साल मनाते हैं । उस दिन देश भर में छुट्टी मनाई जाती है । उस दिन देश भर में तिरंगे झण्डे लहराए जाते हैं । उस दिन वीरों की याद मनायी जाती है जो आजादी की लड़ाई में काम आये थे । हमने आजादी तो पाली, लेकिन उसकी रक्षा करना हमारा कर्तव्य है । अब हममें से हर एक देश का नेता है । देश के लिए अपना तन-मन-धन अर्पण करेंगे ।

शब्द संख्या :: 207

अभ्यास

1. इस गद्यांश का शीर्षक है
(क) पन्द्रह अगस्त (ख) आजादी की लड़ाई (ग) आजादी (घ) त्यौहार

2. अंग्रेजों का शासन हम पर
(क) ढाई सौ बरसों तक था ।
(ख) डेढ़ सौ बरसों तक था ।
(ग) पाँच सौ बरसों तक था ।
(घ) कभी था तो कभी नहीं था ।

3. उन दिनों में "भारतमाता की जय" पुकारना
(क) बेवकूफी का काम था ।
(ख) पागलों का काम था ।
(ग) एक अपराध था ।

(घ) एक फैशन था ।

4. अंग्रेजों के साथ युद्ध करने के लिए हमारे पास
   (क) तोप और बंदूक थे ।
   (ख) तलवार और ढाल थी ।
   (ग) तप, शान्ति और सत्य थे ।
   (घ) सेना थी ।
5. हमें आजादी इस साल में मिली
   (क) सन 1947 (ख) संवत् 1947 (ग) 1947 हिजरी (घ) 1948 ई० ।
6. जो पर्यायवाची शब्द नहीं उसे अलग कीजिए
   (क) आजादी (ख) स्वातंत्र्य (ग) मुक्ति (घ) स्वाधीनता ।
7. हमारे राष्ट्र का झण्डा
   (क) तिरंगा झण्डा है । (ख) पीला झण्डा है ।
   (ग) काला झण्डा है । (घ) सफेद झण्डा है ।
8. आजादी को प्राप्त करने की अपेक्षा आजादी को
   (क) खो बैठना मुश्किल है ।
   (ख) खो बैठना आसान है ।
   (ग) त्योहार के रूप में मनाना जरूरी है ।
   (घ) खोना उत्तम है ।
9. जिसमें विरोधार्थी शब्द ठीक नहीं बैठते उसे अलग कीजिए
   (क) सच × झूठ (ख) भूलना × याद करना
   (ग) पाना × खोना (घ) आजाद × रिहाई ।
10. हमारे राष्ट्रगीत के रचयिता
   (क) रवीन्द्रनाथ ठाकुर (ख) राष्ट्रकवि मैथली शरण गुप्त (ग) राष्ट्रकवि कालिदास (घ) राष्ट्रकवि कुवेंपु ।

दुनिया के अचरज

यूरोप के दक्षिण में यूनान नाम का एक पहाड़ी देश है । प्राचीन काल में यूनान में एक से एक बढ़कर विद्वान, शूरवीर और धार्मिक पुरुष हुए हैं । यूनान के प्राचीन निवासी अपने देवताओं की बड़ी-बड़ी मूर्तियाँ बनाकर उनकी पूजा करते थे । इस प्रकार की सात बड़ी-बड़ी मूर्तियाँ आज भी यूनान की प्राचीन सभ्यता का परिचय दे रही हैं । इन सबमें "रोड्स" की विशाल मूर्ति बड़ी ही आश्चर्यजनक थी और इसकी गणना संसार के सात आश्चर्यों में होती है ।

रोड्स की यह मूर्ति यूनानियों ने इतनी ऊँची बनाई थी कि पुराने जलपोत अपने पालों सहित इस मूर्ति की टाँगों के बीच से निकल जाते थे । यह मूर्ति 'लिशीयत' के शिष्य 'चेयरस' के कार्य-कौशल का नमूना थी । इस मूर्ति का निर्माण करने में चेयरस को पूरे बारह वर्ष लगे । एक हजार तीन सौ साठ वर्ष खड़ी रहने के बाद यह मूर्ति भूकम्प से गिर पड़ी । इसकी ऊँचाई 126 फुट थी । बहुत कम लोग इस मूर्ति के अँगूठे की गहराई नाप सकते थे । जिस समय सीरिया के निवासियों ने ग्रीस टापू पर अपना अधिकार जमाया यह विशाल मूर्ति पृथ्वी पर पड़ी थी । उन्होंने एक यहूदी के हाथ इसे बेच दिया । यह यहूदी इस मूर्ति की पीतल को 900 ऊँटों पर लादकर ले गया ।

इस विशाल मूर्ति का आधार त्रिभुज के आकार का एक भवन था । इस भवन के किनारे संगमरमर के 60 खम्भे लगे हुए थे । इस पर चढ़ने के लिए एक घुमावदार जीना बनाया गया था । ऊपर चढ़कर लोग मूर्ति के गले के चारों ओर लगे हुए दर्पणों द्वारा सीरिया और मिश्र देशों को जाने वाले जलयानों का पता बढ़ी आसानी से लगा लेते थे ।

शब्द संख्या :: 253

अभ्यास

1. इस गद्यांश का शीर्षक है
(क) मूर्ति (ख) पीतल की प्रतिमा (ग) रोड्स की मूर्ति (घ) अचरज

2. यूनान देश — में है
(क) यूरोप (ख) यूरोप के दक्षिण (ग) भारत (घ) अमरिका ।

3. रोड्स की मूर्ति दुनिया की आश्चर्यजनक सात
(क) वस्तुओं में एक है ।
(ख) मूर्तियों में एक है ।
(ग) महापुरुषों में एक है ।
(घ) आदिम निवासी हैं ।

4. रोड्स की मूर्ति को
(क) लिशियस ने बनाया था ।
(ख) चेयरस ने बनाया था ।
(ग) यहूदी ने बनाया था ।
(घ) किसी ने नहीं बनाया बल्कि अपने आप उत्पन्न हुई थी ।

5. इस मूर्ति का निर्माण करने में — वर्ष लगे ।
(क) बारह वर्ष (ख) बीस वर्ष (ग) 126 वर्ष (घ) पाँच वर्ष ।

6. रोड्स की मूर्ति की ऊँचाई
(क) 126 गज थी (ख) 126 किलोमीटर थी ।
(ग) 126 फुट थी । (घ) 126 हाथ थी ।

7. रोड्स की मूर्ति — की थी ।
(क) मिट्टी (ख) पत्थर (ग) संगमरमर पत्थर (घ) पीतल ।

8. जो पर्यायवाची शब्द नहीं उसे बताइये ।
(क) मूर्ति (ख) प्रतिमा (ग) आकृति (घ) विग्रह ।

9. जिसमें विरोधार्थ ठीक नहीं बैठता उसे पहचानिए ।
(क) गिरना × उठना (ख) ऊपर × नीचे (ग) आसान × मुश्किल (घ) ऊँची × नीचे ।

10. हुए, हुई, हुआ, हों, हुई, होवे, होगी, होऊँ आदि शब्दों की मूल-धातु
(क) हो (ख) हों (ग) होवे (घ) हुआ ।

विज्ञान की देन

सूर्य बैटरी या धूप बैटरी धूप से बिजली बनाती है । यह एक नया आविष्कार है जिसका पहला व्यावहारिक प्रयोग सन् 1955 में हुआ । उस साल एक सूर्य बैटरी एक टेलीफोन के खम्भे पर रखी गई और उसे एक टेलीफोन प्रणाली से जोड़ दिया गया। इससे कई टेलीफोन चलने लायक बिजली पैदा हो जाती है । बैटरी के अन्दर सिलिकान नामक तत्व की बनी हुई कई पतरियाँ होती हैं । ये पतरियाँ तार द्वारा जुड़ी रहती हैं । जब इन पतरियों पर धूप पड़ती है तब इलेक्ट्रान छोड़ती हैं । इसे प्रकाश विद्युत-प्रभाव या फोटो-इलेक्ट्रिक इफेक्ट कहते हैं । इलेक्ट्रान तार में प्रवाहित होकर बिजली की धारा बन जाते हैं ।

सूर्य बैटरी धूप के समय ही बिजली की धारा पैदा करती है । जरा-सी बिजली के लिए यह सब झंझट जान पड़ता है । पर हमें याद होना चाहिए, बिजली के पहले जनरेटर बहुत छोटे और कमजोर होते थे, जबकि आधुनिक जनरेटर बिजली की बहुत अधिक मात्रा पैदा करते हैं । इसी तरह हो सकता है कि सूर्य बैटरियों से परीक्षण करते-करते वैज्ञानिक

किसी दिन ऐसे तरीके निकाल लें जिनसे धारा की बहुत बड़ी मात्रा पैदा हो सके। यदि ऐसा हो जाए तो आप अपने घर के आँगन में ही एक सूर्य बैटरी लगाकर अपनी सारी बिजली की जरूरत पूरी कर सकेंगे।

शब्द संख्या :: 203

अभ्यास

1. इस गद्यांश का शीर्षक है
   (क) बिजली (ख) बैटरी (ग) सूर्य बैटरी से बिजली का उत्पादन (घ) टेलीफोन।
2. लेखक का कथन है कि
   (क) सूर्य बैटरी द्वारा अपनी सारी बिजली की जरूरत एक दिन पूरी कर सकेंगे।
   (ख) धूप से बिजली उत्पादन असंभव है।
   (ग) टेलिफोन प्रणाली द्वारा टेलिफोन चला सकते हैं।
   (घ) बिजली से धूप पैदा कर सकते हैं।
3. सूर्य बैटरी का व्यवहारिक प्रयोग इस साल हुआ था।
   (क) सन् 1955 (ख) संवत् 1955 (ग) सन् 1955 से पूर्व (घ) सन् 1950।
4. सूर्य बैटरी के अन्दर सिलिकान नामक पतरियों द्वारा — उत्पन्न करते हैं।
   (क) इलेक्ट्रान-प्रोट्रान (ख) न्यूट्रान (ग) अणु (घ) इलेक्ट्रान।
5. फोटो इलेक्ट्रिक इफेक्ट द्वारा इलेक्ट्रान तार में प्रवाहित होकर — उत्पन्न करता है।
   (क) आवाज (ख) ताप (ग) बिजली की धारा (घ) धूप।
6. सूर्य बैटरी — बिजली उत्पन्न कर सकता है।
   (क) केवल रात में (ख) धूप के समय ही (ग) दिन में (घ) रासायनिक बैटरी की सहायता से ही।
7. जो पर्यायवाची शब्द नहीं उसे अलग कीजिए
   (क) सूर्य (ख) दिनेश (ग) प्रभाकर (घ) सुधाकर।
8. जिसमें विरोधार्थ ठीक नहीं उसे बताइए
   (क) बनना × बिगड़ना (ख) जोड़ना × तोड़ना (ग) धूप × छाया (घ) लायक × नालायक।
9. आविष्कार और आविष्कारक में अंतर क्या है?
   (क) आविष्कार : खोजी हुई वस्तु;
   आविष्कारक : खोज करने वाला।
   (ख) अविष्कार : खोज करने वाला;
   आविष्कारक : खोजी हुई वस्तुएँ।
   (ग) आविष्कार : जो वस्तु नहीं है;
   दोनों का अर्थ खोज करने वाला।
   (घ) कारक को ढूँढ़नेवाला आविष्कारक;
   आविष्कार कारक है।
10. वैज्ञानिक, बिजली जनरेटर आदि
    (क) स्त्रीलिंग शब्द हैं (ख) पुलिंग शब्द हैं (ग) समास युक्त शब्द हैं (घ) सर्वनाम हैं।

प्रकृति का रहस्य

समुद्र का पानी क्यों खारा होता है? सभी समुद्र एक से नमकीन नहीं होते। सतह से लेकर तलहटी तक और एक ध्रुव से दूसरे ध्रुव तक नमक की मात्रा बदलती रहती है। लेकिन औसतन प्रति 100 भाग पानी में $3\frac{1}{2}$ भाग नमक होता है।

अरब और अफ्रीका के गर्म रेगिस्तान के बीच में स्थित लाल सागर सबसे ज्यादा खारा है। यूरोप का बाल्टिक सागर सबसे कम नमकीन है। लाल सागर बाल्टिक सागर की अपेक्षा लगभग छः गुना अधिक नमकीन है।

नदियों द्वारा पृथ्वी से बहाकर लाया गया नमक गुजरते जमाने के साथ समुद्र में इकट्ठा होता जा रहा है। समुद्र में मौजूद खनिजों में से तीन-चौथाई भाग खाने वाला नमक होता है। लेकिन पदार्थ का निर्माण करने वाले आधे से ज्यादा तत्व समुद्र में पाए गए हैं। लोहा समुद्र में पाया जा चुका है और ताँबा तथा सोना भी।

समुद्र से उठने वाले बादलों में ताजा पानी ही होता है। बादल समुद्र में ही नमक छोड़ देते हैं। सृष्टि के प्रारम्भ में गरम पृथ्वी के ऊपर जो पानी बरसा वही चट्टानों से निकल बहुत-सा खनिज पदार्थ समुद्र में मिल गया होगा। और इन करोड़ों बरसों के बीतने के साथ-साथ नदियाँ भी खनिज पदार्थ ला-लाकर समुद्र में डालती रही हैं। हम नहीं जानते कि कितना नमक पहले-पहल चट्टानों से निकलकर समुद्र के पानी में घुल गया था। और कितना बाद में नदियाँ या गरम स्रोतों और ज्वालामुखी पहाड़ों से निकलती भाप से मिला।

शब्द संख्या :: 230

अभ्यास

1. इस गद्यांश का शीर्षक है
   (क) समुद्र (ख) समुद्र का पानी (ग) समुद्र का पानी क्यों खारा होता है (घ) नमक
2. लेखक का कथन है — नमकीन होते हैं।
   (क) सभी समुद्र एक से (ख) सभी समुद्र एक से नहीं (ग) मछलियों के कारण समुद्र (घ) समुद्र हवा के कारण।
3. औसतन प्रति 100 भाग पानी में इतना भाग नमक होता है।
   (क) $3\frac{1}{2}$ (ख) चार (ग) $5\frac{1}{3}$ (घ) 75।
4. जो पर्यायवाची शब्द नहीं उसे बताइए
   (क) समुद्र (ख) सागर (ग) वारिधि (घ) दरिया।
5. लाल सागर बाल्टिक सागर की अपेक्षा इतना गुना नमकीन है।
   (क) चार (च) छ: (ग) सौ (घ) पौने दस।
6. समुद्र में मौजूद खनिजों में इतना भाग खाने वाला नमक है।
   (क) साढ़े तीन (ख) तीन-चौथाई (ग) एक तिहाई (घ) आधा।
7. समुद्र का पानी इसलिए नमकीन है
   (क) नदियों द्वारा पृथ्वी के अन्दर का खनिज लाया जाता है।
   (ख) समुद्र के बीच में नमकीन पहाड़ है।
   (ग) ज्वालामुखी नमक उगलते हैं।
   (घ) मछलियों के सड़ने से नमकीन बनता है।
8. जिसमें विरोधार्थी शब्द ठीक नहीं उसे अलग कीजिए।
   (क) ज्यादा × कम (ख) ताजा × पुराना
   (ग) बाँटना × बटोरना (घ) लेकिन × तुरन्त।
9. नदियाँ कभी-कभी
   (क) सागर में उत्पन्न होती हैं।
   (ख) सागर में आकर मिलती हैं।
   (ग) सागर के बीच में बहती हैं।
   (घ) सागर से प्रेम करती हैं।
10. बाल्टिक सागर — में है।
    (क) भारत (ख) अरब (ग) यूरोप
    (घ) अफ्रीका।

विविध

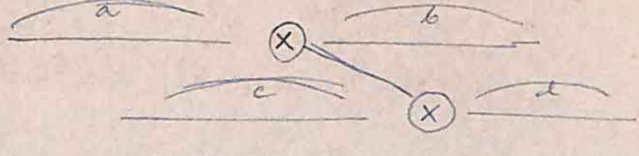
चुम्बकत्व अर्थात् एक वस्तु द्वारा दूसरी वस्तु को आकर्षित करने की विचित्र शक्ति ने शताब्दियों तक मनुष्य को उलझन में डाले रखा। महान मनीषी प्राचीन काल से ही चुम्बक पत्थर के रहस्यों पर मनन करते रहे हैं। वोल्टीय बैटरी के अविष्कार से वैज्ञानिकों को पहली बार विद्युत की एक सम धारा उपलब्ध हुई। अतः बहुतों को संदेह था कि विद्युत और चुम्बकत्व में कुछ न कुछ सम्बन्ध है। इस रहस्य का उद्घाटन हान्स ओरस्टड को आकस्मिक घटना से मिला।

विद्युत-चुम्बक के कई लाभ हैं। हर समय काम में आने वाले उपकरण विद्युतीय घंटी में विद्युत चुम्बक का एक सरलतम आधारभूत उपयोग है।

प्राध्यापक ओरस्टड भौतिकी का पाठ पढ़ा रहा था। पाठ का विषय था वोल्टीय पाइल। प्रयोगशाला की मेज पर बैटरी थी। उसने बैटरी को जोड़ा तो तार में विद्युत-धारा बहने लगी। जिस तार में विद्युत-धारा बह रही थी, कम्पास उसके नीचे पड़ी थी। जैसा कि होना चाहिए था, कम्पास की सुई उत्तर की ओर संकेत नहीं कर रही थी। उसका संकेत पूर्व की ओर था। उसने बैटरी के योजन उलट दिए, जिससे विद्युत-धारा विपरीत दिशा में बहने लगी। अब सुई पश्चिम की ओर संकेत कर रही थी। वहाँ ऐसा चुम्बकत्व था जो कंपास की सुइयों को उत्तर की ओर घुमा रखने वाले चुम्बकत्व से अधिक प्रबल था। **शब्द संख्या :: 209**

अभ्यास

1. इस गद्यांश का शीर्षक है
   (क) चुम्बक (ख) विद्युतीय चुम्बकत्व का आविष्कार (ग) प्रयोगशाला (घ) आकस्मिक घटना।
2. चुम्बकत्व का अर्थ है
   (क) आकर्षित करने की शक्ति (ख) चूमनेवाला (ग) चुम्बन (घ) शून्य।
3. विद्युत और चुम्बकत्व के बीच का सम्बन्ध खोजने वाला व्यक्ति
   (क) एडिसन (ख) गैलवानी (ग) मारकोनी (घ) हान्स ओरस्टड
4. हान्स ओरस्टड यहाँ का रहने वाला था
   (क) अमरिका (ख) रूस (ग) अफ्रीका (घ) फ्रांस
5. विद्युत चुम्बकत्व के आधार पर काम करने वाला उपकरण।
   (क) विद्युतीय घन्टी (ख) घड़ी (ग) प्रयोगशाला (घ) बैटरी।
6. जो पर्यायवाची शब्द नहीं उसे अलग कीजिए
   (क) वस्तु (ख) चीज (ग) सामान (घ) बर्तन।
7. जिसमें विरोधार्थी शब्द ठीक नहीं बैठते उसे बताइए
   (क) कई × कुछ (ख) लाभ × नष्ट (ग) अधिक × बहुत (घ) निकट × दूर।
8. मनीषी का अर्थ है
   (क) ज्ञानी (ख) विज्ञानी (ग) मनुष्य (घ) मुनि।
9. जो दिशा सूचक शब्द नहीं उसे अलग कीजिए
   (क) पश्चिम (ख) उत्तर (ग) दक्षिण (घ) पूर्व।
10. जो उपसर्ग शब्द है उसे पहचानिए
    (क) प्रबल (ख) आधारभूत (ग) प्रयोगशाला (घ) विद्युतीय।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